

NAVIGATION

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34-1. NAVIGATION SYSTEMS AND NAV AIDS

The Navigation System consists of a Global Positioning System, Compass Heading, NAV 1, ADF, Marker Beacon and DME/TACAN systems. Descriptions of the individual components that comprise the systems are contained in this chapter. General inspection and repair or replace instructions are also contained in this chapter.

34-2. INSPECTION PROCEDURES.

NOTE

Directions contained in paragraphs 34-2 through 34-4 apply equally to all avionics components, parts, and bits and pieces. Instructions in these paragraphs are cited only one time, but apply throughout Chapter 34.

1. Inspect control panels for completeness, proper installation, cleanliness and security of mounting.
2. Inspect switches, controls and circuit breakers for proper mechanical action.
3. Inspect panel and indicator lights for housing conditions and proper operation.
4. Inspect electrical connectors for corroded or bent pins, proper mating, and cables for frayed or broken insulation.

34-3. GENERAL CLEANING PROCEDURES.

1. Remove moisture and loose dirt with a clean, soft cloth.
2. Remove dust and dirt from panels (with or without exterior hardware), and light housings with a soft clean cloth. To remove fingerprints or contaminants not responding to a soft clean cloth; use a cloth dampened with water; if necessary, mild soap may be used to make the cleaning more effective.

WARNING

CLEANING COMPOUND IS FLAMMABLE AND ITS FUMES ARE TOXIC.

3. Remove grease, fungus and ground –in dirt with a soft cloth dampened (not wet) with cleaning compound (C-304).

4. Remove dirt from connectors with a brush, remove moisture with a dry cloth.

34-4. GENERAL REPAIR OR REPLACEMENT.

1. Tighten or replace loose or cracked control knobs.
2. Replace defective panel light bulbs or housings.
3. Repairs beyond removal and replacement must be conducted by an authorized repair station.

34-5. NAV 2 RECEIVER (KLN-900 GPS)

The KLN-900 global positioning system receiver is installed as NAV 2 in the TH-57 (C). The KLN-900 is a satellite-based, long-range navigation system. (Figure 34-1). It is FAA-certified for IFR en route, terminal, and nonprecision approach operations. It incorporates an extensive database updated every 28 days that includes most information about the national aerospace system. For detailed operating instructions, see the KLN-900 Pilot's Guide.

The KLN-900 replaces the KNS-81 navigation system in the NAV 2 position. It is located at the top of the center console to optimize display visibility. The GPS utilizes the NAV 2 circuit breaker and the single needle on both RMIs in the VOR position. The system is comprised of the KLN-900 receiver, database card, KA 92 antenna, a DME splitter relay and two GPS panels (pilot's and copilot's).

A DME splitter, located above the copilot's antitorque pedals, enables the pilot and copilot to individually select GPS distance or NAVAID DME information via the NAV 1-NAV 2 switch. Deviation information on the pilot's HSI and the copilot's CDI is also selected via the NAV 1-NAV 2 switch. When the pilot and copilot select the same NAV source, the copilot's CDI will become a repeater of the HSI, and a corresponding CRS INOP light will appear on the copilot's GPS panel (Figure 34-2). TACAN azimuth will not be displayed when both pilot and copilot have selected NAV 2 (GPS) information. VOR and ADF azimuth will not be affected.

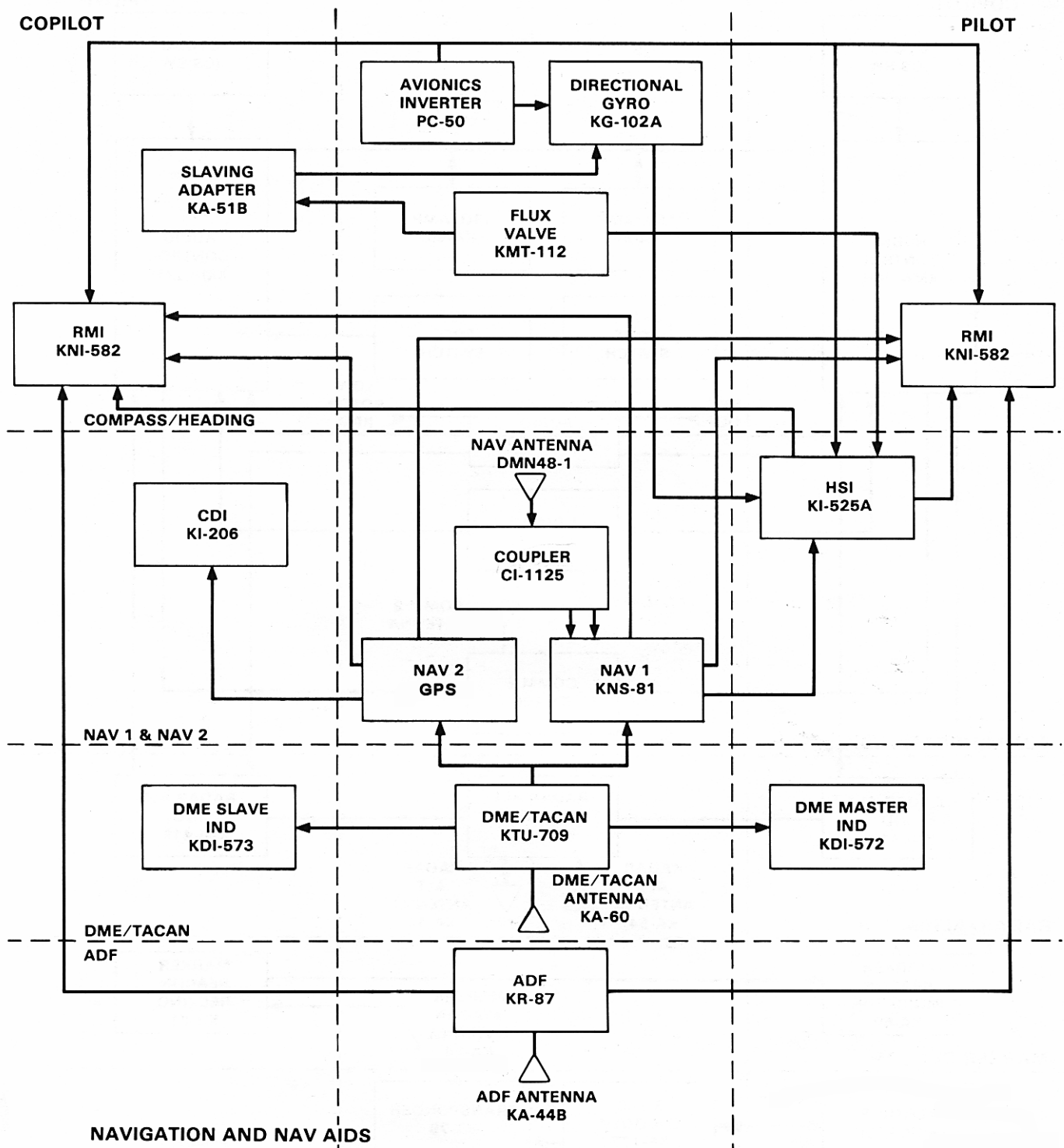


Figure 34-1. Navigation Systems Block Diagram (Sheet 1 of 2)

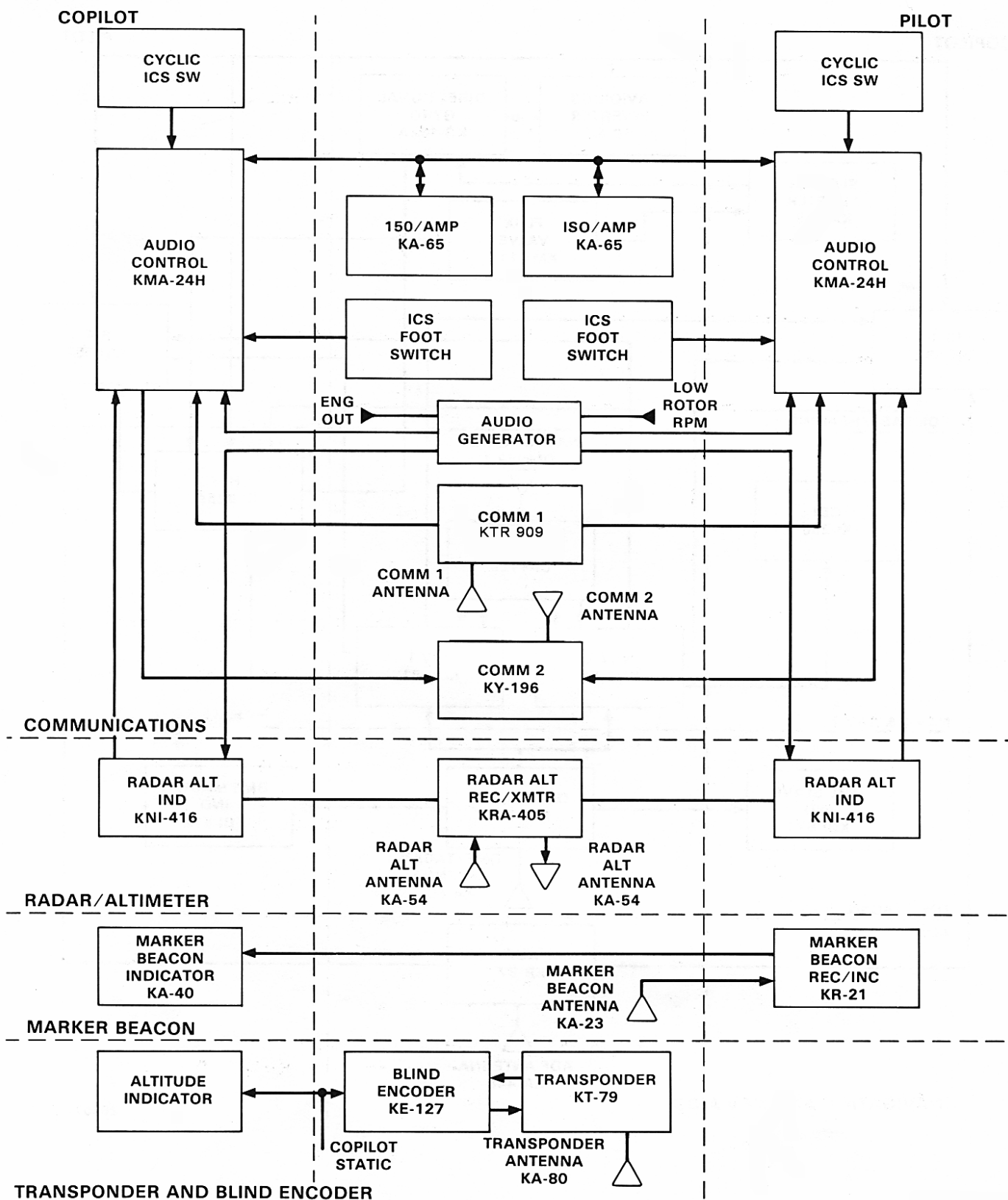


Figure 34-1. Navigation Systems Block Diagram (Sheet 2 of 2)

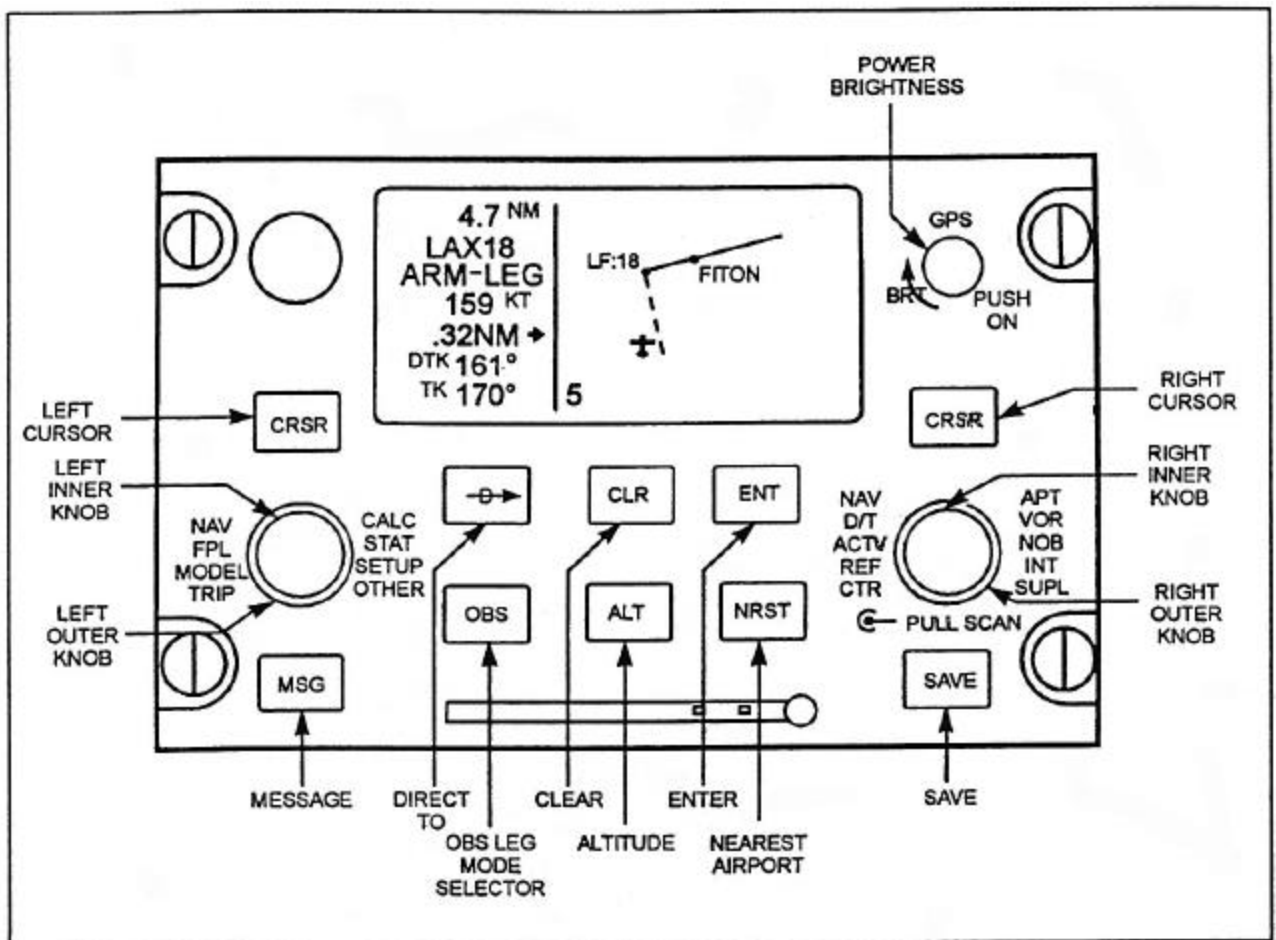


Figure 34-2. KLN-900 GPS

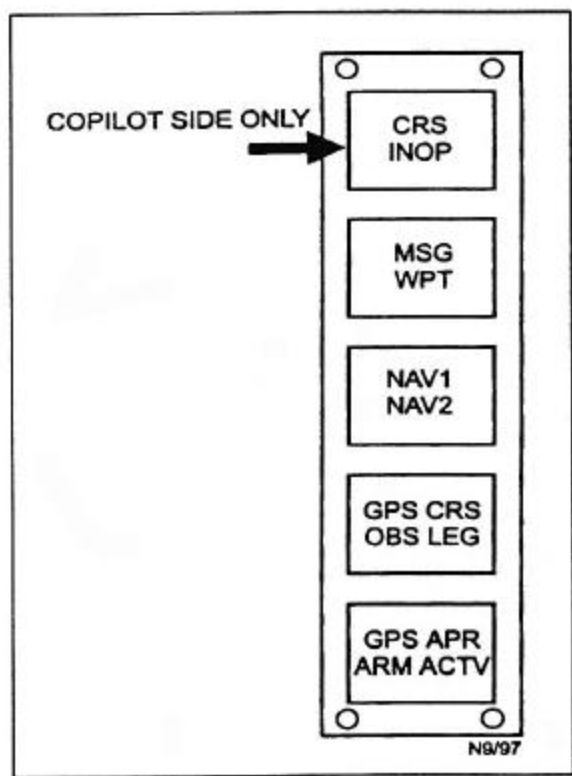


Figure 34-3. GPS Panel

The DME function switch is removed from the pilot's KDI-572, and the hold function is no longer operational. DME is secured via the avionics master switch or the DME circuit breaker.

The pilot and copilot GPS panels (Figure 34-2) consist of four and five lights respectively, three of which are Push Button Switches (PBS). The MSG/WPT light alerts the pilot to a GPS message or an approaching waypoint. The MSG button on the KLN-900 must be depressed to check a message. The NAV 1-NAV 2 PBS toggles between the NAV 1 and GPS distance and deviation as described above. The GPS CRS deviation as described above.

The GPS CRS OBS-LEG pushbutton switch toggles KLN900 deviation between OBS and LEG modes. In the OBS mode deviation is given in miles from the selected bearing. In the LEG mode deviation is given in miles from a line connecting two selected waypoints. CDI scale factors vary; see the KLN 900 Pilot's Guide for details. Depressing the OBS-LEG switch on either the pilot's or copilot's side, or the OBS button on the KLN-900 will toggle

the function. The GPS APR ARM-ACTV switch will arm or disarm a GPS approach and indicates when a GPS approach is active.

The copilot GPS panel is identical to the pilots with the exception of the CRS INOP light located at the top of the copilot's GPS panel.

If power to the GPS is lost, the pilot side will automatically display NAV 1 information. The copilot side will display DME distance but CDI will become inoperative with a flag. These conditions will occur regardless of the position of the NAV 1-NAV2 PBS on each GPS panel. The single needle on each RMI will park at the 90-270 position if NAV (VOR) is selected.

The KLN-900 is integrated with other TH-57C avionics. It receives a heading input from the compass system, and bearing selection from either the HSI or the CDI. The KLN-900 makes outputs to the single needles, the distance displays, the HSI and CDI, and the intercom system via the NAV 2 button on the audio panel.

34-6. POST INSTALLATION CONFIGURATION AND CHECK OUT INTRODUCTION

This section contains the post installation configuration and checkout procedure for the KLN 900. Configuration procedures for the KLN 900 are given in Paragraph 4.3. Messages which may be encountered during the procedures are also defined in each section. Refer to the KLN 900 Pilot's Guide for complete operating instructions.

34-7. CONFIGURATION MODULE

As part of every KLN 900 installation it is necessary to enter the Maintenance (MNT) pages in order to configure the unit properly. Electronically configuring the units replaces the need of installing strapping or configuration wires in the harness. The configuration data is stored both in the configuration module (a Bendix/King KCM 100 mounted externally to the KLN 900) and in memory internal to the KLN 900. When the KLN 900 is initially shipped from the factory, the configuration data is set to default values/status in the KLN 900's internal memory. The initial defaults are specified throughout this chapter. When the Maintenance pages are entered, and changes made to the configuration data, the changes are stored both in the KCM 100 and the KLN 900 internal memory.

NOTE

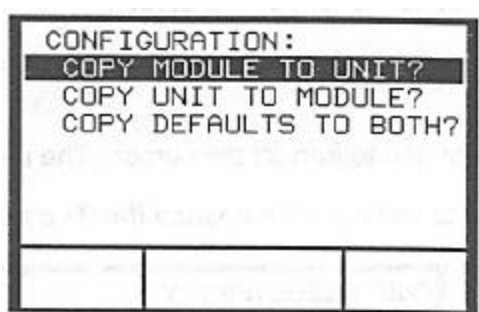
If the configuration data in the KCM 100 differs from that in the KLN 900's internal memory, the KCM 100 data is automatically used. Additionally, the configuration memory is designed such that the configuration modules are both forward and backward compatible (i.e. no errors will result if a KLN 900 with part number 066-04034-0101 is replaced with a KLN 900 with part number 066-04034-0102, or vice versa).

Differences could occur if after configuring the KLN 900 the initial unit was removed and a second unit is inserted into the panel. For example, if the KLN 900 is initially configured correctly, and a loaner unit is later installed in the aircraft, the KCM 100 would ensure that the proper configuration data was used. If there is no KCM 100 interfaced to the KLN 900 on unit startup, the KLN 900 will automatically use its stored configuration data. The KCM 100 configuration module is part of the KLN 900 system (when the KLN 900 is purchased as a system) and should be utilized in every installation to make sure that proper operation occurs, regardless of the KLN 900 that may later be inserted into the mounting panel.

34-8. MAINTENANCE PAGE CONFIGURATION PROCEDURE

To enter the Maintenance (MNT) pages, the MSG button must be depressed before the unit is turned on and continue to be depressed for 10 seconds (- 2 seconds) after turn on. At the end of the 10 second period, release the MSG button for 1 second, and momentarily press the MSG button again. Following this sequence, the unit will automatically enter the Maintenance (MNT) pages.

After the turn-on sequence, but before entering the Maintenance (MNT) pages, a check will be made comparing the configuration data between the KCM 100 and the unit's internal memory. If there is a discrepancy, the following is displayed (this page will not be displayed if they are the same)



1. If you wish to copy the configuration data from the KCM 100 to the unit's internal memory, OR if you plan to manually change the configuration data, simply press the ENT button.
2. If you wish to copy the configuration data from the unit's internal memory to the KCM 100, turn the left outer knob clockwise to position the flashing cursor over the COPY UNIT TO MODULE?, and press the ENT button.
3. If you wish to copy the default configuration values to both the unit's internal memory and to the KCM 100, turn the left outer knob clockwise to position the flashing cursor over the COPY DEFAULTS TO BOTH?, and press the ENT button.

Regardless of which of the three choices you selected, the MNT 1 page will now be displayed. The following procedures apply to all Maintenance (MNT) pages.

1. To change a selection:
Press the left CRSR button to bring the cursor on the screen. Turn the left outer knob to position the cursor over the desired selection. Turn the left inner knob to change the selection. Make any additional changes on this page at this time. When finished, press the left CRSR button to turn off the cursor.
2. To select different MNT pages:
Turn the left inner knob (the cursor must not be on; if it is on, press the left CRSR button to turn it off) to select other MNT pages.

34-9. THE MNT 1 PAGE GENERAL CONFIGURATION, ALTI- TUDE ALERT ENABLE/DISABLE

The MNT 1 page controls the following configurations:

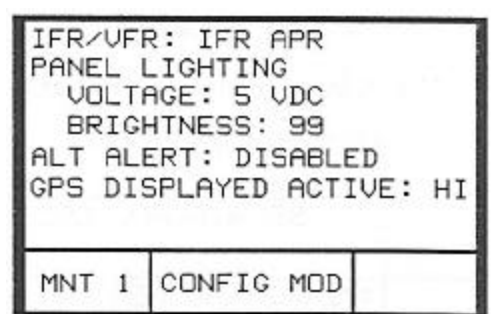


Table 34-1. MAINTENANCE PAGE 1

ITEM	SELECTION CHOICES	DEFAULT
IFRNFR	IFR APR, IFR ENR, or VFR	IFR ENR
Panel Lighting Voltage	VAC, 5 VDC, 14 VDC, or 28 VDC	5 VDC
Panel Lighting Brightness	00 to 99 (99 is brightest)	99
Altitude Alert	Enabled or Disabled	Disabled
GPS Displayed Active	HI or LO	HI

- Whether the unit is certified as (1) IFR enroute, terminal, and non-precision approach, (2) IFR enroute and terminal only, or (3) VFR only.
- The panel lighting bus voltage.
- The brightness of the panel lighting at maximum lighting bus setting.
- Whether the altitude alerting feature is enabled or disabled. If the aircraft has another source of altitude alerting, such as that associated with an altitude preselector, this feature should be disabled.
- Whether the GPS DISPLAYED input pin should be active HI or active LO.

34-10. THE MNT 2 PAGE-SERIAL AIRDATA

The MNT 2 page controls the following configurations (refer to Figure 4-16). Changes are made using the left CRSR button and concentric knobs as described above.

INSTALLED AIRDATA EQUIP AIRDATA RCVR: NONE RS-232 AIRDATA: N		
MNT 2	CONFIG MOD	

- Whether AIRDATA RECEIVER is connected to an ARINC 429 Airdata computer, an ARINC 419 Airdata computer, or is not connected.
- Whether GENERAL RS 232 IN is connected to an Airdata computer or not.

Table 34-2. MAINTENANCE PAGE 2

ITEM	SELECTION CHOICES	DEFAULT
Airdata RCVR	429, 419, or NONE	NONE
RS-232 Airdata	Y (yes) or N (no)	N

34-11. THE MNT 3 PAGE-ANALOG AIRDATA

The MNT 3 page controls the following configurations. Changes are made using the left CRSR button and concentric knobs as described above.

ANALOG AIRDATA: NONE		
MNT 3	CONFIG MOD	

- Whether ANALOG AIRDATA is connected to a source of DC altitude, a source of DC barometric correction, or is not connected.

If a source of DC altitude is selected, the following configuration choices are given :

ANALOG AIRDATA: DC ALT AD VALID STATE: LO INTERNAL REF: N SCALE FACTOR: +60000FT OFFSET: -03000FT		
MNT 3	CONFIG MOD	

Table 34-3. DC ALTITUDE

MANUFACTURER	MODEL	VALID STATE	SCALE FACTOR	OFFSET
Bendix/King	KEA 346	LO	+60000 Ft.	-03000 Ft.
Kollsman/IDC	519-28702-(904 through 911)	LO	+60000 Ft.	-03000 Ft.
Kollsman/IDC	519-28702-901, 902,912	NONE	+40000 Ft.	-02000 Ft.
Smith's	WL 1407	LO	+60000 Ft.	-03000 Ft.

- Whether ANALOG AIRDATA VALID is active HI, LO, or NONE. NONE is used if there is no valid flag for the DC altitude.
- Whether the KLN 900 is supplying an internal reference (excitation) voltage to the DC altitude source. In some cases, an altitude preselector may already be exciting the potentiometer of the altitude source, and it is desired for the KLN 900 not to supply a reference.
- The scale factor to multiply the potentiometer output ratio by to convert to feet of altitude.
- The offset to add to, or subtract from, the result of #3 to get the actual altitude.
- Whether the source of barometric setting is one where the output voltage is linear with baro setting in inches of mercury (HG) or linear with the feet of altitude correction, abbreviated ALT CORR (the difference between pressure altitude and baro-corrected altitude).
- The scale factor to multiply the potentiometer output ratio by to convert to feet of altitude (if the altimeter is altitude-correction linear), or inches of mercury (if the altimeter is baro setting linear).
- The offset to add to, or subtract from, the result of #4 to get the baro correction (in feet or inches of mercury).

NOTE

Table 34-4 contains the proper scale factors and offsets for some popular altimeter models with DC altitude outputs.

If a source of DC barometric setting is selected, the following configuration choices are given:

- Whether ANALOG AIRDATA VALID is active HI, LO, or NONE. NONE is used if there is no valid flag for the DC barometric setting.
- Whether the KLN 900 is supplying a reference (excitation) voltage to the DC barometric source. In some cases, an altitude preselector may already

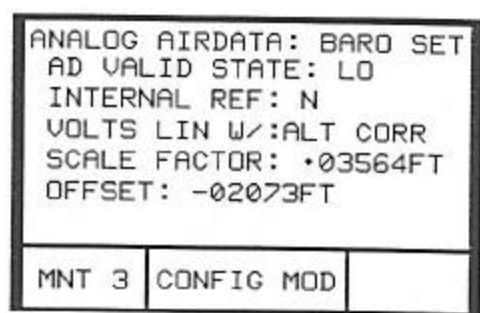


Table 34-4. DC ALTITUDE FORMAT

ITEM	SELECTION CHOICES	DEFAULT
Analog Airdata	DC ALT, BARD SET, or NONE	NONE
AD Valid State	HI, LO, or NONE	LO
Internal Reference	Y (yes) or N (no)	N
Scale Factor	-99999FT to +99999FT	+03564FT
Offset	-99999FT to +99999FT	-02073FT

Table 34-5. ALTITUDE CORRECTION LINEAR

MANUFACTURER	MODEL	VALID STATE	SCALE FACTOR	OFFSET
Bendix/King	KEA 130A	NONE	+03564 Ft.	-02073 Ft.
Bendix/King	KEA 346	LO	+03564 Ft.	-02073 Ft.
Kollsman-IDC	519-28704-)OCX*	NONE	-10310 Ft.	+01546 Ft.

NOTE

The above popular altimeter models are altitude correction linear. If the KLN 900 is interfaced to a model in this list, enter the corresponding scale factor and offset on the MNT 3 page.

*** Except -495**

The following popular altimeter models are baro setting linear. If the KLN 900 is interfaced to a model in this list, enter the corresponding scale factor and offset on the MNT 3 page.

Table 34-6. BARO SETTING LINEAR

MANUFACTURER	MODEL	VALID STATE	SCALE FACTOR	OFFSET
Kollsman-IDC	519-28704-495	NONE	-3.379" HG	+31.365" HG
Kollsman-IDC	519-44929-935	NONE	-2.993" HG	+31.019" HG
LVarious	per ARINC 575-3	VARIOUS	-10.955" HG	+31.573" HG

ANALOG AIRDATA: BARO SET AD VALID STATE: LO INTERNAL REF: N VOLTS LIN W/: "HG SCALE FACTOR: -2.993"HG OFFSET: +31.019"HG		
MNT 3	CONFIG MOD	

Table 34-7. MAINTENANCE PAGE 3 - DC BARO SETTING FORMAT

ITEM	SELECTION CHOICES	DEFAULT
Analog Airdata	DC ALT, BARO SET, or NONE	NONE
AD Valid State	HI, LO, or NONE	LO
Internal Reference	Y (yes) or N (no)	N
VOLTS LIN W/	"HG or ALT CORR (correction)	ALT CORR
Scale Factor	0 to ±99999FT or 0 to ±9.999"	+03564 FT
Offset	0 to ±99999FT or 0 to ±99.999"	-02073 FT

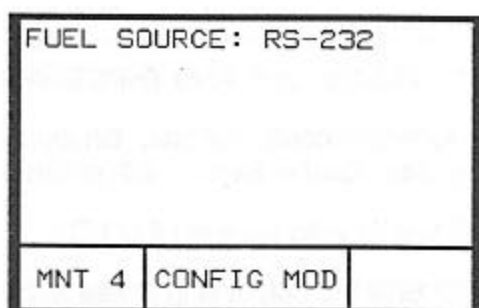
Table 34-8. MAINTENANCE PAGE 4

ITEM	SELECTION CHOICES	DEFAULT
Fuel Source	RS-232 or NONE	NONE

34-12. The MNT 4 Page - Fuel Flow Data

The MNT 4 page controls the following configuration. Changes are made using the left CRSR button and concentric knobs as described above.

- Whether the KLN 900 is interfaced to an RS-232 fuel flow computer, or not connected to a source of fuel data.



34-13. THE MNT 5 PAGE-ARINC TRANSMITTER

The MNT 5 page controls the following configurations. Changes are made using the CRSR button and concentric knobs as described above.

- Whether the KLN 900 ARINC TRANSMITTER will output low-speed (12.5 kbaud) ARINC 429 serial data.
- The SDI (Source/Destination identifier) of this KLN 900. Another way of saying this is: Is this GPS 1 or GPS 2?

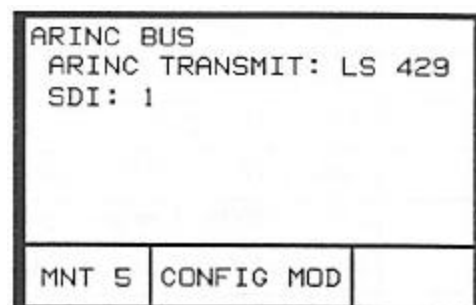


Table 34-9. MAINTENANCE PAGE 5

ITEM	SELECTION CHOICES	DEFAULT
ARINC Transmit	LS 429	LS 429
SDI	1 (GPS 1) or 2 (GPS 2)	1

34-14. THE MNT 6 PAGE-MISCELLANEOUS AND THREE-WIRE DISTANCE

The MNT 6 page controls the following configurations. Changes are made using the left CRSR button and concentric knobs as described in this chapter.

- Whether the HEADING VALID valid state is HI or LO.
- Whether the STEERING SIGNAL output is in phase with FCS 26 VAC REFERENCE when commanding a right turn, or when commanding a left turn.

Table 34-10. MAINTENANCE PAGE 6

ITEM	SELECTION CHOICES	DEFAULT
Heading Valid State	HI or LO	HI
Roll STR Inphase	RIGHT or LEFT	RIGHT
Distance	568, 561 OR 568, 561 AND 568, or KING	KING
IND CTL ACTIVE	s 99.95 or > 99.95	>99.95

3. The type of distance data to output on the SERIAL CLOCK, DATA, SYNC bus.
4. Whether the ARINC 561/568 INDICATOR CONTROL input should be active when the distance to active waypoint is greater than 99.95 NM, or active when the distance to active waypoint is less than or equal to 99.95 NM.

HEADING VALID STATE: HI		
ROLL STR INPHASE: RIGHT		
DISTANCE: KING		
IND CTL ACTV: >99.95		
MNT 6	CONFIG MOD	

Table 34-11. MAINTENANCE PAGE 7

ITEM	SELECTION CHOICES	DEFAULT
TANDEM:	Y (yes) or N (no)	N
MASTER OR SLAVE:	M (master) or S (slave); (only appears if TANDEM is Y)	M
# OF LOCKED FPLS:	1 TO 25, OR NONE	NONE

34-15. THE MNT 7 PAGE-TANDEM AND LOCKED FLIGHT PLANS

The MNT 7 page controls the following configurations. Changes are made using the left CRSR button and concentric knobs.

1. Whether the KLN 900 is installed in Tandem Trainer configuration (two KLN 900s installed in an aircraft, one master and one slave).
2. If part of a Tandem Trainer installation, whether this KLN 900 is the master or the slave unit.
3. The number, if any, of stored flight plans (FPL 1 - FPL 25), which may be "locked", preventing modification during normal KLN 900 operation and flight. The KLN 900 will lock the first flight plans in memory (starting with FPL 1), according to the number specified on the MNT 7 page. For example, if "10" is selected, then FPL 1 through FPL 10 will be locked, while FPL 11

through FPL 25 may be changed by the flight crew.

TANDEM: Y		
MASTER OR SLAVE: M		
# OF LOCKED FPLS: NONE		
MNT 7	CONFIG MOD	

34-16. THE MNT 8 PAGE-CONFIGURABLE ANNUNCIATORS

The MNT 8 page controls the following configurations. Changes are made using the left CRSR button and concentric knobs as described above.

- 1.. Whether CONFIGURABLE ANNUNCIATOR 1 is used for magnetic/true reference annunciation or is unassigned.

Table 34-12. MAINTENANCE PAGE 8

ITEM	SELECTION CHOICES	DEFAULT
CONFIG ANNUN #1 FUNCTION:	MAG/TRUE or UNASSIGNED	MAG/TRUE
ACTIVE STATE:	MAG or TRUE (if MAG/TRUE)	MAG
CONFIG ANNUN #2 FUNCTION:	MAG/TRUE or UNASSIGNED	MAG/TRUE
ACTIVE STATE:	MAG or TRUE (if MAG/TRUE)	TRUE

2. If CONFIGURABLE ANNUNCIATOR 1 is used for magnetic/true annunciation, then select whether the active state is magnetic or true reference.
3. Whether CONFIGURABLE ANNUNCIATOR 2 is used for magnetic/true reference annunciation or is unassigned.
4. If CONFIGURABLE ANNUNCIATOR 2 is used for magnetic/true annunciation, then select whether the active state is magnetic or true reference.

CONFIGURABLE ANNUN#1 FUNCTION: MAG/TRUE ACTIVE STATE: MAG		
CONFIGURABLE ANNUN#2 FUNCTION: MAG/TRUE ACTIVE STATE: TRUE		
MNT 8	CONFIG MOD	

34-17. THE MNT 9 PAGE-OBS CALIBRATION

The MNT 9 page is used to select whether or not the KLN 900 is interfaced directly to an HSI or CDI resolver such that the KLN 900 is able to read the course selected on the HSI or CDI.

NOTE

If the HSI or CDI is connected to a Bendix/King KA 90 Adapter, the OBS signals are calibrated on the KA 90, which in turn sends the selected course to the KLN 900 via ARINC 429.

If the KLN 900 is not connected directly to the HSI or CDI OBS outputs, you must select OBS RESOLVER: N.

OBS RESOLVER: Y		
OBS CALIBRATE ADJUST TO CAL: 129.3		
MNT 9	CONFIG MOD	

The MNT 9 Page is also used to calibrate the OBS setting of the aircraft's HSI or CDI to the KLN 900 so that the KLN 900 reads the value the pilot selects on the HSI or CDI. It is necessary to configure this page only if the OBS calibration factor is not stored in the KCM 100 Configuration Module. To calibrate the OBS:

1. Select a course using the course select/OBS knob on the HSI, or OBS that is interfaced with the KLN 900. It is suggested that a course increment of 10 degrees (example 10,150, 270, etc.) be used so that the course can be selected as precisely as possible.
2. Make sure that the NAV/GPS switch (if installed) is set for GPS.
3. Press the left CRSR button to turn on the cursor.
4. Use the small inner knob to select the exact course that is selected on the HSI or CDI in step 1 above.
5. Press the left CRSR button to turn *off* the cursor. The calibration is now complete.
6. Turn the KLN 900 off to exit the Maintenance (MNT) pages.

34-18. POST INSTALLATION CHECKOUT PROCEDURE

This procedure is divided into two major sections. The first section deals with "Stand Alone" installations in which none of the signal Input/Output capability of the unit is utilized (except for the RF input signal from the antenna). In this type of installation, the only connections to the KLN 900 are the cable from the GPS antenna, the aircraft power and ground leads, and the lighting bus wires.

The second part of this procedure deals with an installation in which some or all of the electrical signal I/O have been utilized. This second section is divided in such a way that each input or output signal is treated separately, and hence only those subsections that apply to a given installation will be conducted.

It is assumed that the Operator's Manual for the various units connected to the KLN 900 (as well as the manual for the KLN 900), are available or that the installer is familiar with operating the units.

34-19. INSTALLATION CHECKOUT

Before applying power to the unit, verify that at the rear connector aircraft power is present on P9001-78 and P9001-51, and that there is a ground on P9001-29, P9001-30, and P9002-27. Check that the lighting bus voltage is present between P9001-71 (H I) and P9001-56 (LO). Verify that there are no voltages or grounds present on any other pins.

1. Verify that the unit mounted muffin fan, or remote mounted blower, is operating properly.
2. Energize the unit by placing the ON/OFF switch in the On position.
3. Verify the panel lighting works properly.
4. Manipulate the controls as necessary to display the NAV 2 Page on the right half of the screen and the SET 1 Page on the left half of the screen. On the SET 1 Page, enter the present position for the installation location accurate to within 60 nautical miles. Display the SET 2 Page. Verify that the date and time are correct to within 10 minutes, and update if necessary.
5. At this point, the aircraft will have to be moved to a location known to have reasonable GPS signal coverage. This implies an outside location away from tall structures that could mask low elevation satellites.
6. Display the STATUS 1 Page. The state shown on the page should change to Acquire (ACO) and after a period of not more than 5 minutes (typically two minutes depending on the satellite coverage), the unit should display Latitude and Longitude values on the NAV 2 page that are correct for the installation location.
7. Display the STATUS 1 Page, and verify that no asterisks appear next to any satellite with an elevation greater than 25°. Select 121.15 MHz on COMM 1. Transmit on COMM 1 for a period of 20 seconds, and verify that no asterisks appear on the STATUS 1 Page for satellites with an elevation greater than 25°. Repeat for the following frequencies of 121.175, 121.20, 131.250, 131.275, and 131.30 MHz. Repeat the above procedure for all VHF COMM's on the aircraft.

8. If any of the above tests do not pass (any asterisks appear on satellites with greater than 25° elevation during the above tests), it will be necessary to identify the source of the interference. There are two common sources of interference:

- a. The 12th and 13th harmonics of the above mentioned frequencies can be radiated from the VHF R/T at a level strong enough to be a problem to the GPS, but still be low enough to meet TSO requirements for the VHF COMM. If the interference is from the radiating VHF COMM, an optional notch filter will need to be installed. The recommended location for the inline filter should be as close to the VHF R/T as practical.
- b. The other possibility is the re-radiation from an ELT. The radiated RF from the VHF COMM can excite the output tank circuit of the ELT, and cause it to oscillate and radiate RF strong enough to interfere with the GPS. If disconnecting the ELT antenna eliminates the GPS interference, the manufacturer of the ELT should be contacted for a recommended solution.

34-20. INTEGRATED INSTALLATION CHECKOUT

The following paragraphs define checkout procedures for all possible Input/Output signals that can be connected to the KLN 900. It should be clearly determined which of these signals are intended to be used in any given installation, and then only the paragraphs pertaining to those signals should be performed.

34-21. ALL INSTALLATIONS

Perform all steps defined in paragraph 34-18, and leave the system energized with a valid GPS signal being received.

34-22. EFIS OR CDI/HSI INTERFACE

Cycle the power on the KLN 900, which will cause the SELF TEST Page to be displayed. Verify that the CDI needle, after it has settled, is indicating half-scale right deflection. If a vertical deviation needle is connected to the KLN 900, verify that it is indicating half-scale up deflection. Verify that the TO/FROM flag is indicating FROM. Verify that the NAV flag is pulled from view.

Verify the selected course from the EFIS or CDI/HSI is interfaced properly to the KLN 900, in the OBS mode. The OBS mode can be selected by two methods:

1. The OBS/LEG selection can be controlled by means of a GPS CRS external switch/annunciator. Each press of the switch/annunciator will cause the mode to change between OBS and LEG.
2. Each press of the OBS button on the KLN 900 unit will cause the mode to change between OBS and LEG.

Verify that the selected course value on the MODE Page agrees with the value displayed on the EFIS Course Pointer or the HSI Course Pointer, if it is a remotely driven type. Press the left cursor button and modify the selected course value. Again, verify the course pointer tracks the new value. Change the selected course value on the EFIS, HSI or CDI using the OBS knob. Verify that the selected course value displayed on the MODE Page tracks the new value selected.

In the OBS mode with the GPS displayed on the CDI/HSI, the resolver is disconnected from the NAV converter. Verify that the KNS 80 or 81 groundspeed is still functional, and the radial display for the KX 165 or KNS 81 is still functional. These units must have jumpers or resistors across them when the resolver is removed.

In the OBS mode with the GPS not displayed on the CDI/HSI, the resolver is reconnected to the NAV converter. Verify that change in the OBS resolver will not affect the selected OBS on the KLN 900.

34-23. RADAR GRAPHICS INTERFACE

Activate a flight plan. Verify that the flight plan can be observed on the Radar Graphics display. Select a "Joystick" waypoint on the Radar Graphics unit. Verify that the selected waypoint appears on the SUP Page of the KLN 900 display.

34-24. AIR DATA INTERFACE

With altitude being supplied by a compatible Air Data Computer or DC altitude source, verify that the proper altitude is indicated on the ALT page (provided the proper baro setting has been entered and if the Air Data Computer does not provide baro-corrected altitude).

34-25. GRAY CODE ALTITUDE INPUTS

With gray code altitude being supplied by a compatible encoding altimeter, verify that the proper altitude is indicated on the ALT Page (provided no other altitude sources are active and that proper baro setting has been entered).

Verify that there is no interference between the KLN 900, transponder, and any other loads on the encoding altimeter output. Remove power from each of the loads on the encoder to verify that the remaining equipment still performs properly. If interference exists, one or more of the units are not diode isolated and isolation diodes will need to be added to the aircraft wiring.

34-26. DC BARO SETTING INTERFACE

With the SELF TEST Page displayed, verify that the barometric setting is correct. There must be a valid source of Gray Code or other pressure altitude for the baro setting to be displayed. Adjust the baro set knob on the altimeter and verify that the value displayed on the SELF TEST Page changes accordingly.

34-27. RMI INTERFACE

Cycle power on the KLN 900 which will cause the SELF TEST Page to be displayed. Verify that the RMI indicates 130°.

34-28. ELT INTERFACE (ARTEX ELS-10)

The following test must be conducted within five minutes after the hour with ELT transmissions limited to 3 (three) sweeps. A sweep occurs each time there is a voice transmission. Verify that the present position is displayed on the KLN 900 NAV 2 Page. Activate the COMM receiver and tune it to 121.50 MHz. Switch the ELT cockpit toggle switch to TEST. The ELT light should flash and the "sweeping" sound of the ELT should be heard on the COMM receiver. Within 1 (one) minute, a voice transmission should be heard which contains the present position displayed on the KLN 900 NAV 2 Page. Switch the toggle switch to AUTO, and push the reset button until it stops flashing.

34-29. MOVING MAP INTERFACE

If the KLN 900 is interfaced to a moving map display, verify operation by moving the aircraft out to an open location to acquire a satellite position. Enter some active flight plan or waypoint to develop a presentation on the map. Some moving maps require 30 KTS of speed to display as the sense track angle is used instead of the heading. Output track angles below 30 KTS are not output.

34-30. EXTERNAL ANNUNCIATORS

Cycle power on the KLN 900 which will cause the SELF TEST Page to be displayed. Verify that all external annunciators are energized. Cycle the KLN 900 display past all initialization pages. Verify that all external annunciators are extinguished. If the message light comes on, view the MSG Page to verify that there is a message. If any other annunciator remains lighted, review the status of the KLN 900 to determine if the lighted annunciator is justified. OBS and LEG annunciators are controlled by the KLN 900. Toggle the GPS CRS switch to verify that the annunciator switch matches the KLN 900 mode.

NOTE

Annunciators should be checked one at a time in order to verify that the correct one illuminates.

34-31. DISTANCE INDICATOR

Cycle power on the KLN 900 which will cause the SELF TEST Page to be displayed. Verify that during the self test, the distance indicator displays 34.5 NM, 0 KTS, 0 MIN. If the distance indicator may be switched between GPS and NAV, switch it to NAV and verify that it displays NAV/DME data correctly.

34-32. DATA LOADER

NOTE

The updating of the data base cartridge through the use of a laptop computer is entered here only as information. The TH-57C KLN 900 data base cartridge is updated through a subscription service via an exchange basis.

The data base cartridge may be updated using a 3.5" disk and a laptop computer. The laptop computer must be IBM compatible, have an open COM 1 or COM 2 serial port, and have a 3.5" high density diskette drive.

Connect an IBM compatible laptop via the PC loader kit. Set the KLN 900 to the SET O Page. Put the #1 diskette into the PC. Cycle the power of the PC, and follow the menu driven instructions.

NOTE

The KLN 900 data base may be updated using a PC with the KLN 900 mounted in the aircraft.

34-33. ALTITUDE ALERT AUDIO

Upon approval of the SELF TEST Page, five (5) beeps will be issued on the audio output and five (5) sonalert bursts will be produced by the ALT ALERT output, if ALT ALERT is not configured low.

34-34. HEADING INTERFACE

Heading information may be interfaced to the KLN 900 by ARINC 429, XYZ Synchro, or RS 232, to aid in the calculation of wind vectors and for heading orientation of the NAV 5 or moving map, and to enable the ARINC 429 roll steering output. ARINC 429 heading information is provided from an EFIS 40/50 system or a KA 90 Interface Adapter, through the EFIS 429 receiver. RS 232 heading information may be provided from an analog to RS 232 converter, such as the Shadin fuel/air data device, through the RS 232 input.

Display the NAV 5 Page and select the HDG orientation to test the heading function. If a valid heading source is available, HDG orientation will be selectable. If the heading is from an RS 232 source, it will be necessary to have a valid GPS position before the heading input will be recognized. ARINC 429 heading information is recognized with or without a valid position, and may be tested in the hangar.

NAVIGATION AND REFERENCE SYSTEMS

34-35. COMPASS/HEADING SYSTEM DESCRIPTION.

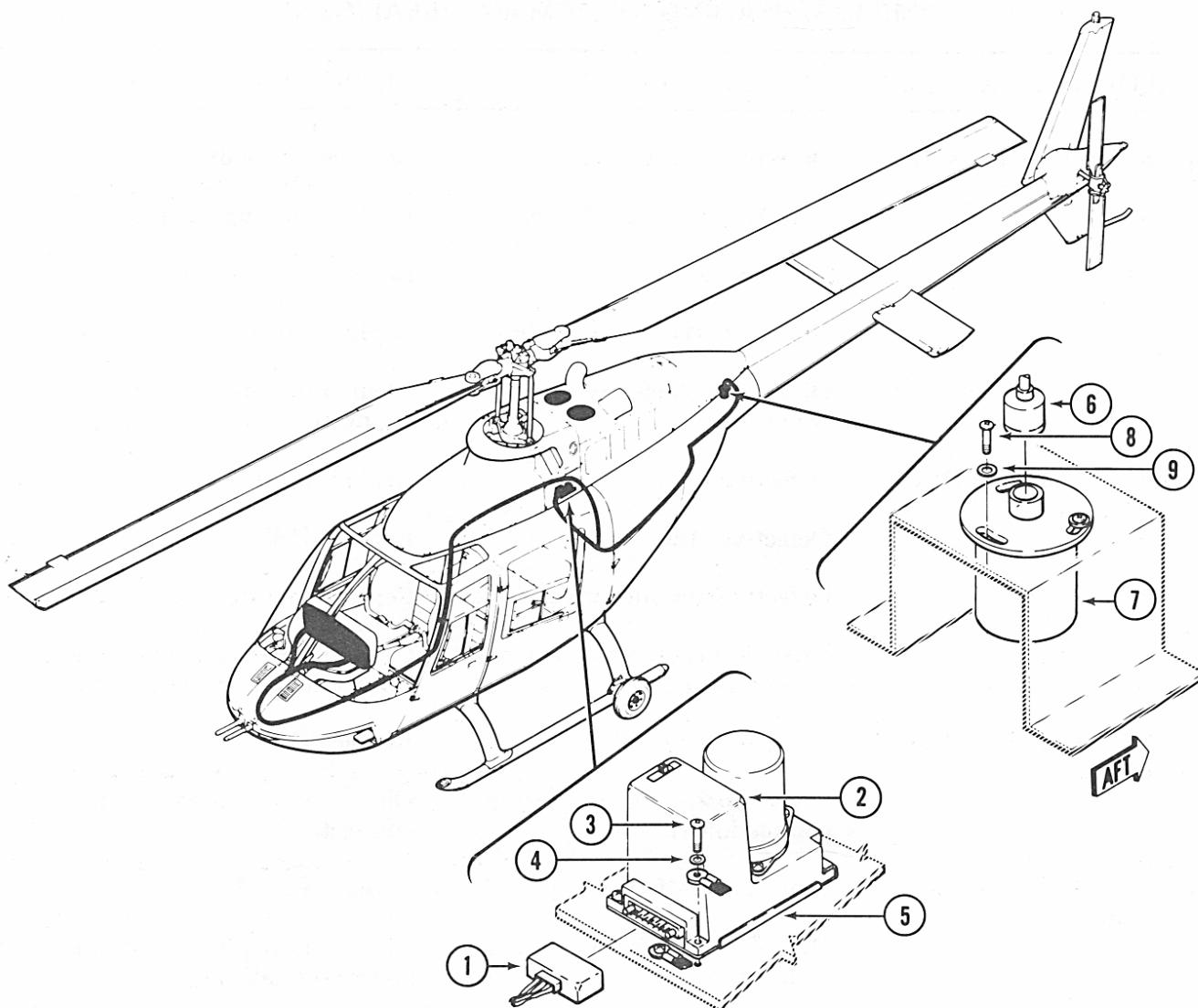
The KCS-55A compass system (Figure 34-3) consists of a directional gyro (KG-102A), a flux valve (KMT-112), a slaving accessory (KA-51B), and horizontal situation indicator (HSI) (KI-525A). Two radio magnetic indicators (RMI's) (KNI-582) are bootstrapped to the compass. The avionics inverter (PC-50) provides 26 vac for HSI and RMI's. This offers a slaved compass indication to the aircrew. Refer to Appendix F for Compass Swing Procedures.

34-36. NAVIGATIONAL SYSTEMS AND NAVIGATIONAL AIDS DESCRIPTION.

1. An RNAV unit (KNS-81), distance measuring equipment (DME)/TACAN (KTU-709), a master DME indicator (KDI-572), and a slaved DME indicator (KDI-573) provide NAV, RNAV and TACAN capabilities. The RNAV is utilized as the right seat primary (NAV), and is coupled to the HSI (KI-525A). The RNAV and/or TACAN is available to either operator (Figure 34-4.).
2. The (KNI-582) can also receive inputs from both RNAV systems. NAV information is selectable for display on the single needle of both RMI's. Information from the automatic direction finder (ADF) is presented by either or both needles of each RMI as selected (Figure 34-4.).
3. Glideslope information is provided by RNAV units and will be displayed on the HSI and CDI. A marker beacon unit (KR-21) and a remote unit (KA-40) are utilized to provide MKR BCN information to both operators (Figure 34-4.).

34-37. COMPASS/HEADING SYSTEM (KCS-55A).

1. The KI-525A horizontal situation indicator (HSI), KG-102A directional gyro (DG), KMT-112 magnetic flux valve, and KA-51B slaving adapter make up the compass/heading system. Two KNI-582 radio magnetic indicators (RMI's) bootstrapped to the compass system, offer indication to both operators. The PC-50 avionics inverter furnishes 26 vac for gyro excitation and HSI and RMI drive/positioning.
2. The HSI displays the horizontal navigation situation. Manual controls allow course and heading selections. Outputs from the HSI are applied to each RMI, with the exception of glidescope information.
3. The DG is a remote mounted unit which, in conjunction with the flux valve provides a gyro-stabilized magnetic heading to the HSI. The DG contains an internal power supply which generates excitation voltages for the flux valve and positive and negative dc voltages for the HSI and slaving adapter.
4. The flux valve senses helicopter position relative to the earth's magnetic field. This information, separately and combined with the DG input, is applied to the HSI.
5. The slaving adapter is panel mounted. It contains the slaving mixer, slaving switches, and corrector circuitry which compensates for the effect of local magnetic disturbances of the flux valve.



1. Connector
2. Directional Gyro KG-102A
3. Screw (2)
4. Washer (2)
5. Shock Mount
6. Connector
7. Flux Valve KMT-112
8. Screw
9. Washer

Figure 34-4. Compass/Heading System Component Locations

34-38. OPERATIONAL CHECK-COMPASS/ HEADING SYSTEM (KCS-55A).



BEFORE CONNECTING EXTERNAL ELECTRICAL POWER; VERIFY THE FOLLOWING:

- 1. ESS 1 BUS SUPPLY BAT CIRCUIT
BREAKER IS OPEN**
- 2. BUS TIE RELAY CIRCUIT BREAKER
IS OPEN**
- 3. BOTH AVIONICS MASTER/OFF
SWITCHES ARE OFF.**

NOTE

Air Conditioning and Position Lights
MUST be OFF.

1. Accomplish the following:
 - a. Connect external power to the helicopter.
 - b. Apply power to essential 1 and essential 2 buses. (Refer to paragraph 23-11.)

NOTE

The following operational check provides only cursory verification of the system. To ensure system integrity, the helicopter has to be positioned on a compass rose for compass swing/alignment and/or system validation.

NOTE

When power is applied, but the DG is not up to operating speed, a red warning flag labeled HDG will be visible in the upper right quadrant of the HSI. When the DG reaches operating speed the red HDG warning flag will retract and be out of view. When power or DG speed drop below minimum limits, the red HDG warning flag will come into view.

2. If the system is in the slaved gyro mode, the compass card will automatically fast slave at the rate of 180 degrees per minute until actual magnetic heading is indicated. This compass card movement should be quite evident upon initial power application. The system will continue to

slave at a constant rate of three degrees per minute to keep the system aligned with the earth's magnetic field.

3. If the system is in the free gyro mode, check the slaving meter to determine whether there is right or left deflection. If slaving is desired, depress the appropriate manual slave pushbutton to center the needle and align the system with the earth's magnetic field.

4. A red flag labeled NAV in the upper left quadrant of the HSI will be retracted after a valid navigation signal has been received. This warning flag will reappear whenever the navigation signal is of insufficient strength or power to the system is lost.

5. For navigation, set the NAV receiver to a desired VOR or VORTAC station. The red NAV flag will disappear from view if a usable signal is being received.

6. Rotate the course selector knob to position the selected course pointer to the desired VOR/VORTAC course.

7. The VOR deviation bar represents the selected course. The relationship of this bar to the aircraft symbol in the center of the instrument indicates angular difference between the selected course and your helicopter position. (When this angular difference on the HSI has been negated, the helicopter is on course with selected VOR/VORTAC station).

8. For an ILS approach, tune the NAV receiver to the desired frequency. If a usable localizer signal is being received, the NAV warning flag will disappear.

9. A front or back course approach may be selected by positioning the course pointer to the inbound localizer course with the course selector knob. The LOC deviation bar represents the desired course. The relationship between this bar and the aircraft symbol represents the angular difference between your helicopter and the localizer station.

10. The glidescope deviation pointers will become visible on both sides of the display when a usable glidescope signal is received. If they do not come into view, a glidescope signal is not being transmitted or the signal is of insufficient strength.

11. The glidescope pointers indicate position of the helicopter with respect to the glidescope path (pointers above the center marker indicate the helicopter is below the glidescope).

34-39. TROUBLESHOOTING-COMPASS/HEADING SYSTEM (KCS-55A)

NOTE

For troubleshooting, refer to navigation and navigational aid systems wiring diagram, Chapter 98.

NOTE

Reference to position(s) in troubleshooting chart is intended to mean “pilot” and/or “copilot”.

34-40. DIRECTIONAL GYRO (KG-102A).

The KG-102A directional gyro (DG) is located on the remote unit platform behind the crew compartment, above the baggage compartment. The DG supplies the basic heading reference of the compasses/heading system. In addition, it converts 28 vdc helicopter power to the various voltages required by the gyro and other system components. It converts the flux valve slaving error signals to digital pulses, which are summed with the digital gyro-signals in the HSI slaving adapter. The DG accepts and processes the auto and manual slaving commands from the slaving adapter to control speed and direction of the slaving activity.

34-41. REMOVAL-DIRECTIONAL GYRO (KG-102A).

1. Ensure that electrical power is off.
2. Disconnect electrical connector (1, Figure 34-3) from directional gyro (2).
3. Remove screws (3), washers (4), and ground-wire terminals attaching directional gyro to shock mount (5).
4. Remove directional gyro.

34-42. INSTALLATION-DIRECTIONAL GYRO (KG-102A).

1. Ensure that electrical power is off.
2. Attach directional gyro (2, Figure 34-3) to shock mount (5) using screws (3) and washers (4). Attach ground wire terminals under screw head.
3. Connect electrical connector (1) to directional gyro (2).
4. Perform operational check of compass/ heading system. (Refer to paragraph 34-34.)

34-43. FLUX VALVE (KMT-112).

The KMT-112 flux valve (Figure 34-3) is bracket mounted and located behind the tailboom attachment access panel. The flux valve senses and measures the direction and magnitude of a magnetic field and converts this information to phase-oriented signals. These signals are used in the slaved and unslaved mode of operations to cause compass card displacement. Flux valve output and DG displacement signals continuously interact to effect valve stability and gyro drift correction.

34-44. REMOVAL-FLUX VALVE (KMT-112).

1. Ensure that electrical power is off.
2. Remove tailboom attachment access panel.
3. Disconnect cable connector (6, Figure 34-3) from flux valve (7).
4. Remove screws (8) and washers (9) attaching flux valve to mounting.
5. Remove flux valve.

34-45. INSTALLATION-FLUX VALVE (KMT-112).

1. Ensure that electrical power is off.
2. Install flux valve (7, Figure 34-3) with “FORE TOP” arrow pointing forward. Secure with screws (8) and washers (9).
3. Connect cable connector (6) to flux valve (7).
4. Perform Compass swing. (See Appendix F, Compass Swing Procedures.)

Table 34-13. COMPASS/HEADING SYSTEM (KCS-55A)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
HDG flag will not retract.	Defective gyro.	Replace gyro.
	Defective HSI.	Replace HSI.
	Dirty/loose/defective wiring/connection(s) and or circuit breaker(s)	Clean/tighten/repair wiring/connection(s) and/or replace circuit breaker(s).
Compass card does not stabilize.	Defective slaving adapter.	Replace adapter.
	Defective gyro.	Replace gyro.
	Defective flux valve.	Replace flux valve.
	Defective avionics inverter.	Replace inverter.
	Dirty/loose/defective wiring/connection(s).	Clean/tighten/repair wiring/connection(s).
Compass card does not slave.	Defective flux valve.	Replace flux valve.
	Defective slaving adapter.	Replace adapter.
	Defective gyro.	Replace gyro.
	Dirty/loose/defective wiring/connection(s).	Clean/tighten/repair wiring/connection(s).
No heading display on HSI.	Defective gyro.	Replace gyro.
	Defective HSI.	Replace HSI.
	Defective avionics inverter.	Replace inverter.
	Dirty/loose/defective wiring/connection(s).	Clean/tighten/repair wiring/connection(s).
No heading display on RMI in both positions.	Defective HSI.	Replace HSI.
	Dirty/loose/defective wiring/connection(s).	Clean/tighten/repair wiring/connection(s).
No heading display on RMI in one position.	Defective RMI.	Replace RMI.
	Dirty/loose/defective wiring/connection(s).	Clean/tighten/repair wiring/connection(s).

34-46. SLAVING ADAPTER (KA-51B).

The KA-51B slaving adapter is panel mounted immediately below the instrument panel and adjacent to the left edge of the comm/nav equipment console. The mode select switch in the panel allows for selection of “slaved” or “free” gyro operation. The slaving meter in the panel depicts approximate and relative magnitude and direction (plus or minus) of magnetic deflection in the unslaved (free gyro) mode. Applicable positioning of the manual slave switch (CW or CCW) will center the slaving meter pointer, and in turn will cause appropriate compass card precession. The adapter combines flux valve and DG parameters in the slaved mode, determines (automatic) speed and direction of the slaving signals, and generates three-phase signals for HSI display positioning.

34-47. REMOVAL-SLAVING ADAPTER (KA-51B).

1. Ensure that no electrical power is applied.
2. Remove two mounting screws from panel.
3. Slide adapter free from mount.
4. Disconnect two electrical connectors.
5. Remove adapter.

34-48. INSTALLATION-SLAVING ADAPTER (KA-51B).

1. Ensure that electrical power is off.
2. Connect two electrical connectors to rear of adapter.
3. Slide adapter into mount.
4. Secure adapter to mount with two mounting screws.
5. Perform Compass swing. (See Appendix F, Compass Swing Procedures)

34-49. NAVIGATION AND NAVIGATIONAL AIDS SYSTEMS.

1. The navigation and navigational aids systems consist of NAV 1 and NAV 2, automatic direction finder (ADF), marker beacon, distance measuring equipment (DME)/TACAN, and transponder with blind (altitude) encoder systems. These systems interface with the compass/heading system and audio/ICS.

2. The NAV 1 and NAV 2 system is a dual VOR/localizer (LOC) and glidescope (GS) system consisting of one KNS-81 receivers, a KI-206 course deviation indicator (CDI), a split DMN48-1 antenna, and a CI-1175 antenna coupler.
3. The KNS-81 receiver extracts audio from the received (VOR/LOC) signals, converts it to a 1020 Hz signal, which is made available to the KMA-24H audio/ICS control.
4. A KI-515A horizontal situation indicator (HSI) (part of the KCS-55A compass/heading system) is used as the indicating device to compliment the KI-206 CDI; the HSI portrays NAV 1 system and the CDI NAV 2 system information.

34-50. OPERATIONAL CHECK – NAV 1 SYSTEM (KNS-81).



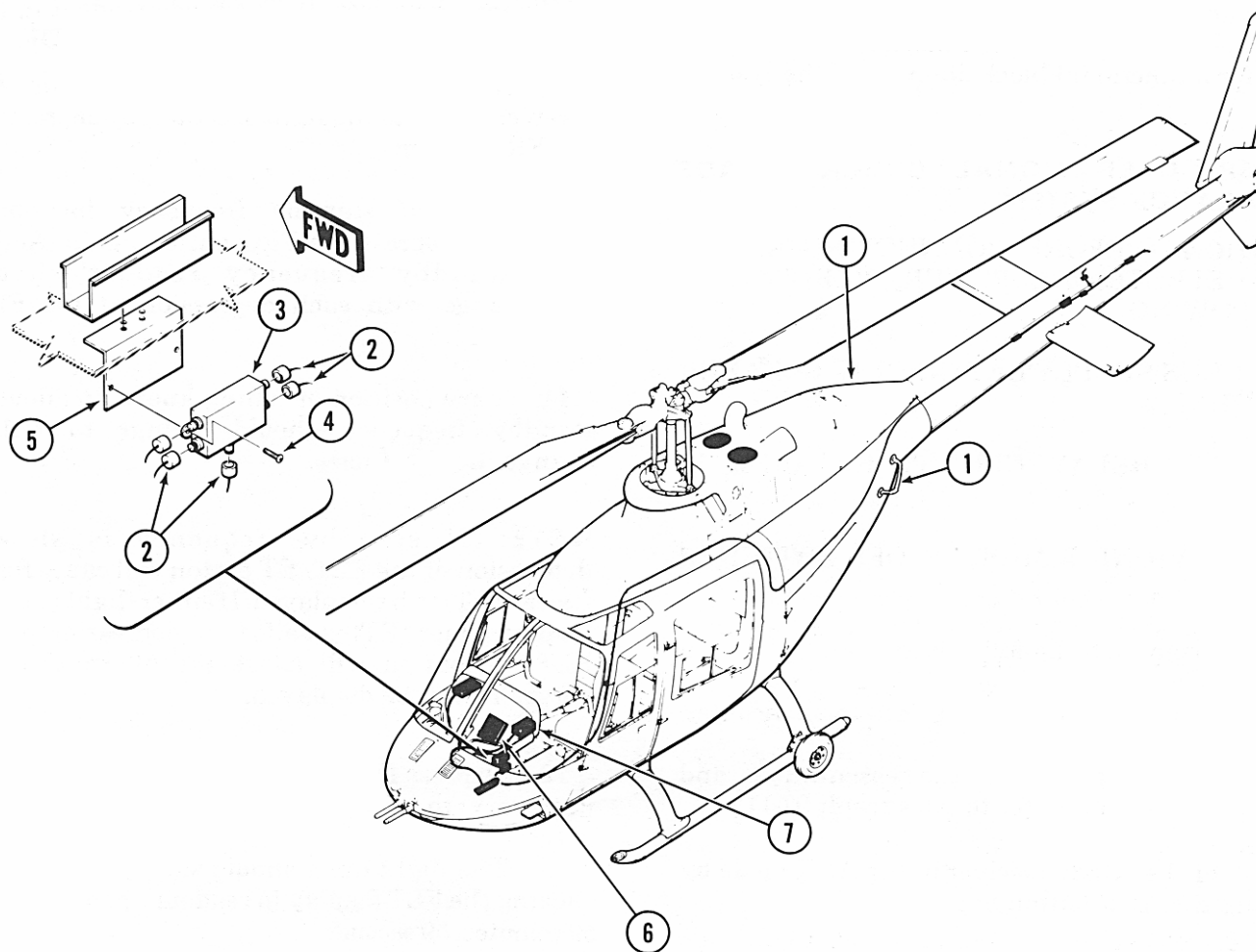
BEFORE CONNECTING EXTERNAL ELECTRICAL POWER, VERIFY THE FOLLOWING:

- 1. ESS 1 BUS SUPPLY BAT CIRCUIT BREAKER IS OPEN.**
- 2. BUS TIE SUPPLY BAT CIRCUIT BREAKER IS OPEN.**
- 3. BOTH AVIONICS MASTER/OFF SWITCHES ARE OFF.**

1. Accomplish the following:
 - a. Connect external power to the helicopter.
 - b. Apply power to essential 1 and essential 2 buses. (Refer to Chapter 23.)

NOTE

The following procedure is performed without test equipment; instead it uses a VOR/DME station of known distance and bearing. For a ground check using test equipment, refer to KING manual “KNS-81 Installation Manual”. NAV 1 is coupled to the HSI and to the CDI. Though the following procedure calls out directions for use of the omni bearing select (OBS) knob on the CDI, the same directions apply to the heading set knob on



1. NAV Antenna DMN48-1
2. Antenna Cable Connector (3)
3. Antenna Coupler CI-1125
4. Screw (2)
5. Angle
6. Receiver KNS-81 (1)
7. CDI KI-206

Figure 34-5. NAV 1 System Component Locations

the HSI. Momentary depression of the DATA button on the face of the NAV 1 receiver moves the caret (\succ) between categories of data (FRQ, RAD, DST) and activates this data storage function. During the following procedure, activate the 1020 Hz tone by pulling out the OFF/PULL IDENT knob on the NAV 1 receiver, whenever HSI and/or CDI reflect that the NAV 1 receiver is aligned with an operating VOR station. Tone should be audible in headset.

2. Apply power to KNS-81 receiver by turning OFF/ON/PULL IDNET control clockwise.
3. With MODE selector (large knob on left side of receiver face), call up VOR on mode annunciator and insert frequency of station into FRQ with data input control.
4. With the OBS knob, align (center) the deviation (D) bar to the VOR bearing of the station with the TO flag shown on the face of the indicator. Record radial angle.
5. With the waypoint select knob(s) (right side of receiver face), insert radial angle 90 degrees greater than the recorded VOR radial into the NAV 1 receiver.
6. With the waypoint select knob(s) insert a waypoint distance (DST) into the NAV 1 receiver, equal to the value reflected by the DME indicator.
7. Call up RNAV and the NAV receiver with the MODE select knob.
8. With the OBS knob, align (center) D-bar to the new bearing with the TO flag shown on the face of the indicator.
9. The DST (distance-to-station) should now read $1.41 (\sqrt{2})$ times the DME indicated distance (± 0.5 NM).
10. The RAD (selected course) readout should be 45 degrees (± 2 degrees) greater than recorded VOR radial angle.
11. Call up VOR on the NAV receiver with the MODE select knob.
12. With the OBS knob, align (center) the deviation (D) bar to the VOR bearing of the station with the TO flag shown on the face of the indicator. Record radial angle.
13. With the waypoint select knob(s), insert radial angle 120 degrees greater than the recorded VOR radial into the NAV 1 receiver.
14. With the waypoint select knob(s), insert a waypoint distance (DST) into the NAV 1 receiver.
15. Call up RNAV on the NAV receiver with the MODE select knob.
16. With the OBS select knob, align (center) D-bar to the new bearing with the TO flag shown on the face of the indicator.
17. The DST (distance-to-station) should now read $1.41 (\sqrt{2})$ times the DME indicated distance (± 0.5 NM).
18. The RAD (selected course) readout should be 60 degrees (± 2 degrees) greater than the recorded VOR radial angle.
19. Momentarily depress the CHK button on the face of the NAV 1 receiver.
20. The RAD and DST readouts on the NAV 1 receiver should change to indicate radial angle and distance *from* the VOR station.
21. Depress the RAD button.
22. The ground speed indicated on the DME (remote) indicator should change.
23. The RAD readout should reflect a bearing *from* the waypoint of 240° greater than the radial angle of the VOR station.
24. Position OFF/ON/PULL IDENT control to OFF.
25. Remove power from essential 1 and essential 2 buses.
26. Remove external power from helicopter.

Table 34-14. NAV 1 SYSTEM (KNS-81)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
NAV 1 receiver panel light(s) inoperative.	Defective panel lamp(s). Dirty/loose/defective wiring and/or connection(s). Defective receiver.	Replace lamp(s). Clean/tighten/repair wiring and/or connection(s). Replace receiver.
No VOC/LOC audio, one receiver.	Respective receiver inoperative. Respective KMA-24H audio/ICS panel inoperative. Dirty/loose/defective coaxial cabling/connections. Dirty/loose/defective ground and/or power wiring and/or connection(s).	Replace receiver. Replace panel. Clean/tighten/repair/cabling connection(s). Clean/tighten/repair wiring and/or connection(s).
No VOC/LOC audio, both receivers.	Defective VOR/LOC antenna. Defective antenna coupler. Dirty/loose/defective coaxial cabling/connections. Dirty/loose/defective ground and/or power wiring and/or connection(s).	Replace antenna. Replace coupler. Clean/tighten/repair/cabling connection(s). Clean/tighten/repair wiring and/or connection(s).
TO-FROM flag in HSI or CDI 180 degrees out of phase with station selected.	Defective HSI or CDI. Dirty/loose/defective wiring and/or connection(s).	Replace indicator. Clean/tighten/repair wiring and/or connection(s).
Pointer No. 1 and/or No. 2 on HSI or CDI inoperative.	Defective HSI or CDI. Respective receiver inoperative. Dirty/loose/defective wiring and/or connection(s).	Replace indicator. Replace receiver. Clean/tighten/repair wiring and/or connection(s).

TABLE 34-14. NAV 1 SYSTEM (KNS-81) (CONT.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
No glidescope indication on HSI or CDI.	Defective HSI or CDI.	Replace indicator.
	Respective receiver inoperative.	Replace receiver.
	Dirty/loose/defective wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).
No glidescope indication on HSI and CDI.	Defective antenna.	Replace antenna.
	Defective antenna coupler.	Replace coupler.
	Dirty/loose/defective coaxial cabling/connections.	Clean/tighten/repair/cabling connection(s).
	Dirty/loose/defective ground and/or power wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).

34-51. TROUBLESHOOTING - NAV 1 SYSTEM (KNS-81).

NOTE

For troubleshooting, refer to Table 34-14 and the navigation and navigational aid systems and audio/ICS wiring diagram, Chapter 98.

34-52. NAV 1 RECEIVER (KNS-81).

1. A KNS-81 receiver is installed in the radio console (Figure 31-10 (35)). Each receiver consists of a VOR localizer (LOC) receiver, an area navigation (RNAV) computer, and a glidescope
2. Combined with an HSI (KI-525A), a CDI (KI-206), and distance measuring equipment (DME) (KTU-709), the receiver forms a complete navigation system featuring two modes of VOR, two modes of RNAV, and ILS with glidescope (G/S) capabilities. The receiver simultaneously identifies one of nine waypoint and displays waypoint/station frequency, radial angle, and distance. Momentarily depressing the CHK button calls up VOR radial and DME distance on the receiver display. Depressing the RAD button initiates readout of bearing from VORTAC or waypoint on the DME indicator in place of ground speed.
3. Nonvolatile memory (NVM) offers indefinite waypoint storage. An automatic panel display

dimming circuit compensates for changes in ambient light.

34-53. REMOVAL-NAV 1 RECEIVER (KNS-81).

1. Ensure that electrical power is off.
2. Using 3/32 inch Allen wrench, turn (counterclockwise) locking screw on face of receiver (Figure 31-10 (35)) until receiver disengages from mounting rack.
3. Remove receiver.

34-54. INSTALLATION-NAV 1 RECEIVER (KNS-81).

1. Ensure that electrical power is off.
2. Looking at bottom of receiver, ensure lobe of holddown device is in vertical position.
3. Slide receiver into rack until lobe of holddown device contacts rack.



DO NOT OVER TIGHTEN SCREW.

4. Using 3/32 inch Allen wrench, turn locking screw on face of receiver clockwise until receiver is secure.
5. Perform operational check of NAV 1 system. (Refer to paragraph 34-46.)

34-55. NAVIGATION (NAV) ANTENNA (DMN48-1).

The DMN48-1 NAV antenna (Figure 34-4) is a balanced loop antenna consisting of two semi-circular center half-loops. The half-loops are horizontally mounted on opposite sides in the fuselage immediately forward of the tailboom interconnect. The antenna halves are connected with a cable harness to provide a single, low VSWR50 ohm load. The antenna is constructed for a frequency range of 108-122 MHz, for reception of VOR/LOC/RNAV and ILS/GS signals.

34-56. REMOVAL-NAV ANTENNA (DMN48-1).

1. Ensure that electrical power is off.
2. Gain access to antenna halves (1, Figure 34-4) through opening in baggage compartment roof and through tailboom joining access panel.
3. Disconnect antenna cable connectors from antenna.
4. Remove nuts, doublers, washers, and screws securing antenna to structure.
5. Remove antenna.

34-57. INSTALLATION – NAV ANTENNA (DMN48-1).

1. Ensure that electrical power is off.
2. Remove old sealing compound from antenna mounting surface.
3. Mount antenna halves (1, Figure 34-4) on structure using screws, washers, doublers, and nuts.
4. Protect antenna from moisture by applying fillet seal around antenna mounts using silicon adhesive (C-300).
5. Connect antenna cable connectors to antenna.
6. Perform operational check of NAV 1 system. (Refer to paragraph 34-46.)

34-58. ANTENNA COUPLER (CI-1125).

1. The CI-1125 antenna coupler (Figure 34-4) adapts received VOR/LOC, NAV 1, and ILS/GS signals for NAV (1) receiver usage. The coupler has two BNC male jacks for NAV functions and two BNC male jacks for VOC/LOC and GS functions. The coupler provides a 50 ohm load and is mounted behind the instrument panel console of the helicopter.

34-59 REMOVAL-ANTENNA COUPLER (CI-1125).

1. Ensure that electrical power is off.
2. Remove left lower pedestal panel.
3. Disconnect antenna cable connectors (2, Figure 23-8) from coupler (3). Identify cables.
4. Remove screws (4) attaching coupler (3) to angle (5).

34-60. INSTALLATION-ANTENNA COUPLER (CI-1125).

1. Ensure that electrical power is off.
2. Attach coupler (3, Figure 34-4) to angle (5) using screws (4).
3. Connect antenna cable connectors (2) to coupler (3) as identified.
4. Install access panel.
5. Perform operational check of NAV 1 system. (Refer to paragraph 34-46.)

34-61. ADF NAVIGATIONAL SYSTEM.

The automatic direction finder (ADF) system consists of a KR-87 ADF receiver, two KNI-582 radio magnetic indicators (RMI's), and a KA-44B antenna. The ADF receiver is mounted in the radio console; the RMI's are mounted in the instrument panel at the pilot and copilot position. The KA-44B antenna is mounted on the underside of the helicopter below the radio console. Refer to Figure 34-7 for a functional block diagram of the system.

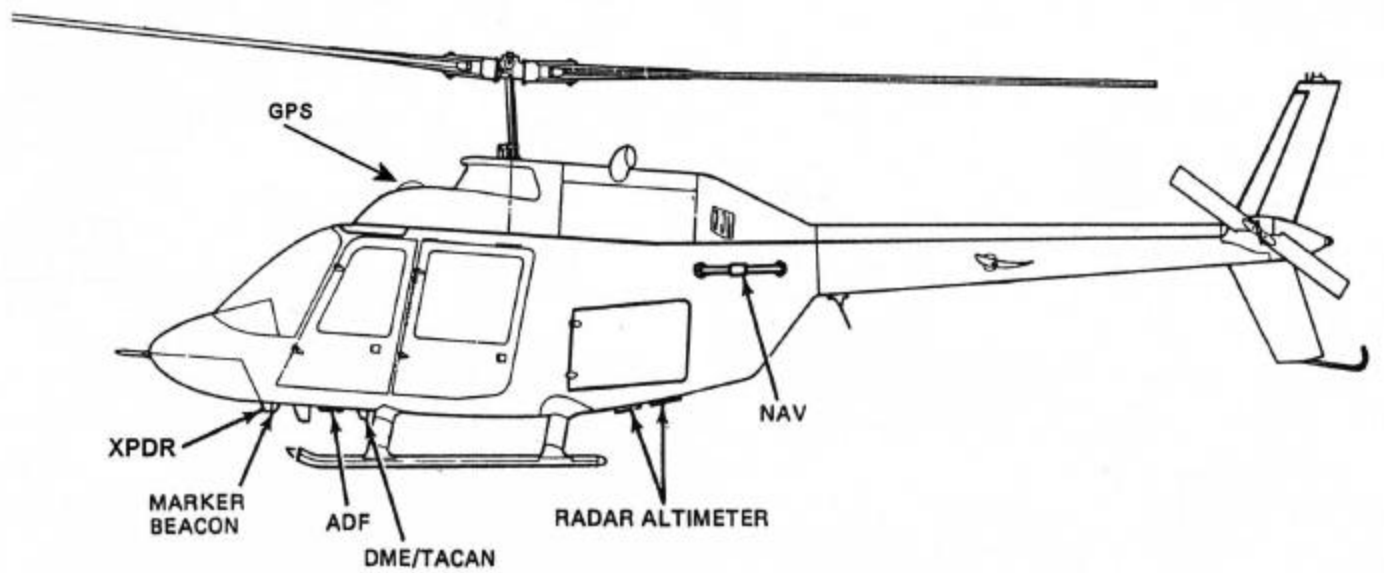


Figure 34-6. Antenna Location

34-62. OPERATIONAL CHECK-ADF NAVIGATION SYSTEM.



BEFORE CONNECTING EXTERNAL ELECTRICAL POWER, VERIFY THE FOLLOWING:

- 1. ESS 1 BUS SUPPLY BAT CIRCUIT
BREAKER IS OPEN.**
- 2. BUS TIE RELAY CIRCUIT BREAKER
IS OPEN.**
- 3. BOTH AVIONICS MASTER/OFF
SWITCHES ARE OFF.**

1. Accomplish the following:
 - a. Connect external power to the helicopter.
 - b. Apply power to the essential 1 and essential 2 buses. (Refer to Chapter 23.)
2. Put the KR-87 receiver in the ANT mode by pulling the ADF button out.
3. The pointer on the RMI's should remain "parked" at approximately 090 degrees relative position. The display in the left side of the receiver panel should read ANT.
4. Tune receiver to several stations known to be operating. The active frequency readout appears in the left side of the receiver panel as receiver is tuned. Clear audio should be present in headset(s).
5. Put the receiver in the BFO mode by pushing in the BFO button.
6. Tune to a station. A 100Hz signal should be audible in headset(s). If the station uses an interrupted carrier the signal heard will be the station identification tone.
7. Put receiver in the ADF mode by pushing in the ADF button.
8. The pointers on the RMI's should indicate station bearing (any of the two pointers in the RMI's may be selected). The mode readout in the left side of the receiver panel should be ADF.

9. Call the standby frequency up on the receiver panel (to right of center) by depressing the FRQ button.
10. After a standby frequency has been displayed, depress the FRQ button again. Active and standby frequency readout should interchange with each depression of the FRQ button.
11. Vary position of tuning knobs. Readout of standby frequency should change to reflect change in frequencies.

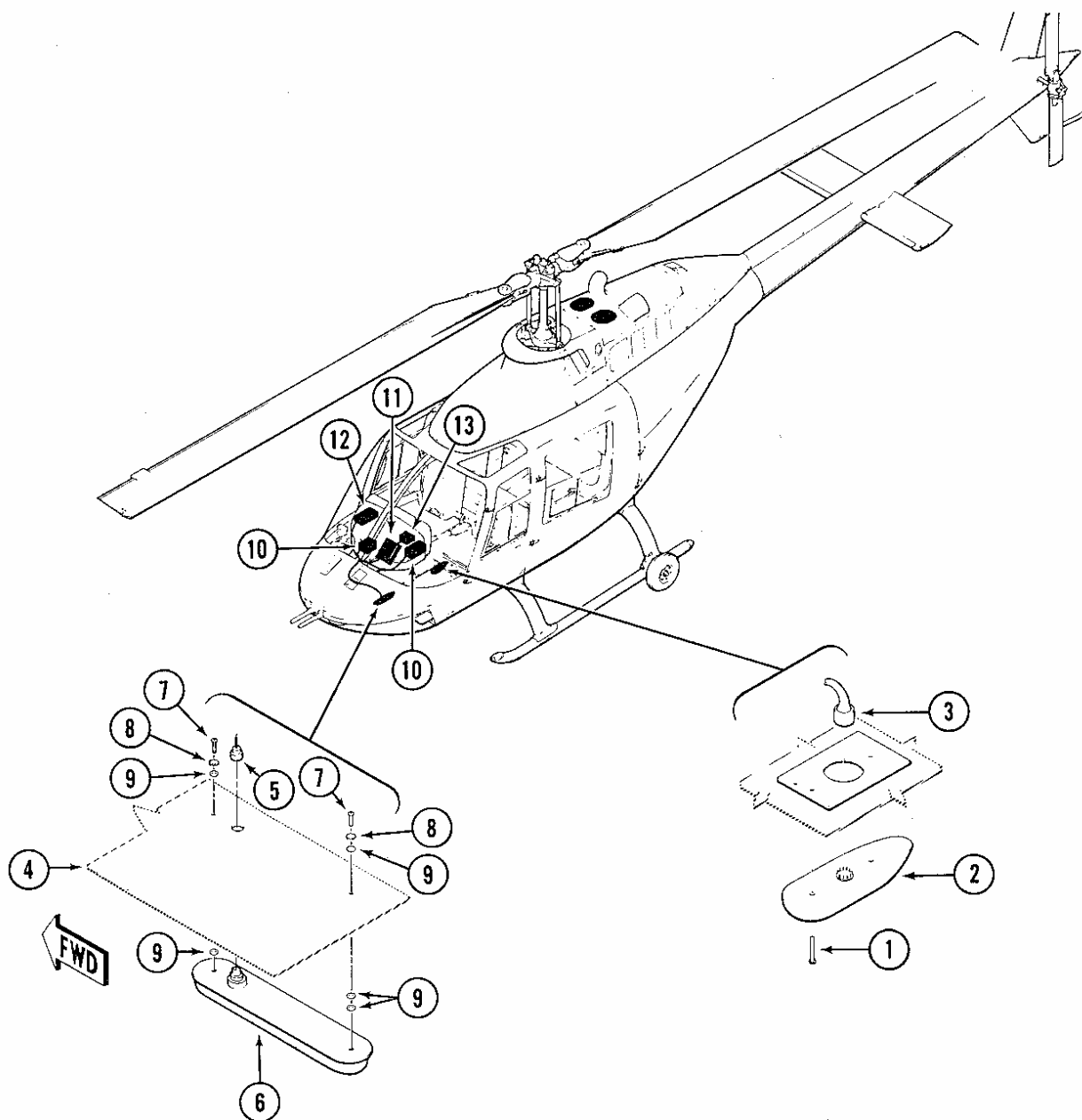
NOTE

If standby frequency is shown, depression of the FLT/ET button will cause flight timer (FLT) to be displayed. If either flight timer or elapsed timer (ET) is called up, depression of the FLT/ET button will cause the alternate (FLT versus ET) to be displayed.

12. Depress FLT/ET button (more than once if necessary) to call up flight (FLT) timer.
13. The flight timer should start counting and causing the FLT display to readout up to 59 hours, 59 minutes, 59 seconds.
14. Remove power from receiver, and subsequently, reapply power by turning the OFF/VOL knob fully counterclockwise (CCW) and then clockwise (CW).
15. Flight timer should have reset and should start counting up again from zero.

NOTE

The elapsed timer has two modes; count up and count down. The count up mode commences at zero. To select the count down mode, depress the reset (SET/RST) button for approximately two seconds until the ET readout starts flashing; release the button at this time. Total time from which to count down, is entered by turning the concentric (tuning) knobs (maximum 59 hours, 59 minutes, 59 seconds). Depression of the SET/RST button one more time will initiate countdown. The count down starts from the time entered by turning the concentric knobs, towards zero. At zero the display commences flashing for 15 seconds.



- | | |
|--|---------------------------------------|
| 1. Screw (2) | 8. Washer (2) |
| 2. ADF Antenna KA-44B | 9. Washer (5) |
| 3. ADF Antenna Cable Connector | 10. RMI KNI-582 (2) |
| 4. Access Panel | 11. ADF Receiver KR-87 |
| 5. Marker Beacon Antenna Cable Connector | 12. Marker Receiver / Indicator KR-21 |
| 6. Marker Beacon Antenna KA-23 | 13. Light Adapter KA-40 |
| 7. Screw (2) | |

Figure 34-7. ADF Navigation and Marker Beacon Systems Component Locations

16. Depress FLT/ET button to call up elapsed time (ET).
17. The elapsed timer should start counting up.
18. Depress the reset (SET/RST) button.
19. The elapsed timer should reset at zero, and commence counting up again.
20. Initiate count down mode (see NOTE, above).
21. The elapsed timer should start counting down from preset time into receiver.
22. Vary setting on OFF/VOL knob.
23. Audio strength in headset should vary.
24. Position OFF/VOL knob fully CCW to OFF.
25. Remove power from essential 1 and essential 2 buses.
26. Remove external power from helicopter.

34-63. TROUBLESHOOTING-ADF SYSTEM.

NOTE

For troubleshooting, refer to Table 34-15 and navigational systems and audio/ICS wiring diagrams, Chapter 98.

34-64. ADF RECEIVER (KR-87).

1. The KR-87 ADF receiver is a digitally tuned, solid state receiver which provides bearing information to stations and audio reception in the 200 KHz to 1700 KHz frequency band. It enables the aircrew to identify stations and listen to weather or commercial transmission in the AM broadcast band.
2. The receiver has an illuminated readout panel which always displays the active ADF frequency in the left side. The right readout (close to center of the panel) either displays the standby frequency (which can be transferred to the active readout location) or flight timer or programmable elapsed timer values. The flight timer tracks total flight time in hours, minutes, and seconds. The programmable elapsed timer can be reset to count up from zero or be preset to a value from which to count down towards zero, in hours, minutes and seconds. An alarm output from the receiver is available to activate an optional, additional, visual or aural device when the preset value has counted down to zero. This option offers nonprecision times approaches, and enhances full management and dead reckoning navigation.

Table 34-15. ADF SYSTEM

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
ADF system inoperative.	Defective receiver. Dirty/loose/defective wiring and/or connection(s) or circuit breaker.	Replace receiver. Clean/tighten/repair/replace wiring and/ or connection(s) or circuit breaker.
No audio output in ANT and/or ADF mode.	Defective KMA-24H audio control panel. Defective receiver. Dirty/loose/defective coaxial cabling/connections. Defective sense antenna. Dirty/loose/defective ground and/or power wiring connection(s).	Replace audio panel. Replace receiver. Clean/tighten/repair/ cabling connection(s). Replace antenna. Clean/tighten/repair ground and/ or power wiring connection(s).
Receiver does not tune to correct frequency.	Defective receiver. Dirty/loose/defective ground wiring/connection(s).	Replace receiver. Clean/tighten/repair wiring/ connection(s).

Table 34-15. ADF SYSTEM (Cont'd)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Both RMI's out of phase with ADF bearing.	Defective receiver. Defective loop antenna. Defective sense antenna. Dirty/loose/defective coaxial cabling/connections. Dirty/loose/defective ground and/or power wiring connection(s).	Replace receiver. Replace antenna. Replace antenna. Clean/tighten/repair/cabling connection(s). Clean/tighten/repair ground and/or power wiring connection(s).
One RMI out of phase with ADF bearing.	Defective RMI Dirty/loose/defective/wiring and/or connection(s).	Replace RMI. Clean/tighten/repair wiring and/or connection(s).

3. An automatic dimming circuit adjusts the brightness of the display to compensate for changes in ambient light level. A single chip microprocessor is used to control the display, provide timer functions, control the tuning circuitry, and provide timing reference signals. Nonvolatile memory (NVM), electrically alterable memory (EAROM) stores the active and standby frequencies after power to the receiver has been removed.

WARNING

DO NOT OVERTIGHTEN SCREW.

4. Using a 3/32-inch Allen wrench, turn locking screw until receiver is secure.
5. Perform operational check of ADF Navigation System. (Refer to paragraph 34-58.)

34-65. REMOVAL-ADF RECEIVER (KR-87).

1. Ensure that electrical power is off.
2. Using 3/32 inch Allen wrench, turn receiver locking screw counterclockwise until receiver disengages from its mounting rack.
3. Remove receiver.

34-66. INSTALLATION-ADF RECEIVER (KR-87).

1. Ensure that electrical power is off.
2. Looking at the top of the receiver (Figure 34-6), ensure the front lobe of the holddown device is in a vertical position.
3. Slide receiver into mounting rack until front lobe touches mounting rack.

34-67. ADF ANTENNA (KA-44B).

The KA-44B antenna (Figure 34-6) is an integral part of the ADF navigation system. It contains both the loop and sense antennas as well as an electronics package with active circuitry. The circuitry amplifies the antenna signals, then phase modulates them into a form that is readily demodulated into bearing information by the receiver.

34-68. REMOVAL-ANTENNA (KA-44B).

1. Ensure that electrical power is off.
2. Remove screws (1, Figure 34-6) from underside of antenna (2).
3. Lower antenna to gain access to the antenna cable connector (3). Disconnect connector.
4. Remove antenna.

34-69. INSTALLATION-ANTENNA (KA-44B).

1. Ensure that electrical power is off.
2. While supporting antenna (2, Figure 34-6) beneath helicopter, connect antenna cable connector (3).
3. Align and install antenna. Secure with screws (1).
4. Perform operational check of ADF system. (Refer to paragraph 34-58.)

34-70. MARKER BEACON SYSTEM.

1. The marker beacon system consists of a KR-21 marker beacon receiver, a KA-40 light adapter, and a KA-23 antenna.
2. The KR-21 receiver provides aural and visual indication when the helicopter passes over marker beacons located on ILS approach courses. The carrier frequency of the marker beacon transmitters is 75 MHz. Signals processed by the receiver are routed to the KMA-24H audio/ICS panel and simultaneously to the front panel display of the receiver and the KA-40 light adapter.
3. The audio/ICS accepts the signals for presentation in the headsets, a low (400 Hz) tone in dashes when passing the outer marker, a medium (1300 Hz) tone in dots and dashes when passing the middle marker and a steady high (3000 Hz) pitch tone when passing the inner (approach or airfield) marker. Corresponding illumination of a blue, amber, and white light, labeled O, M and A, respectively, on the front panel display of the receiver and the light adapter, visually compliment these audio presentations. Refer to Figure 34-7 for a functional block diagram of the system.

34-71. OPERATIONAL CHECK-MARKER BEACON SYSTEM.



BEFORE CONNECTING EXTERNAL ELECTRICAL POWER, VERIFY THE FOLLOWING:

1. **ESS 1 SUPPLY BAT CIRCUIT BREAKER IS OPEN.**

2. BUS TIE RELAY CIRCUIT BREAKER IS OPEN.

3. BOTH AVIONICS MASTER/OFF SWITCHES ARE OFF.

Test equipment capable of generating a square wave modulated 75 MHz carrier is required for the following test procedure. Direct or space coupling of test equipment to receiver may be used.

1. Accomplish the following:
 - a. Connect external power to the helicopter.
 - b. Apply power to the essential 1 and essential 2 busses. (Refer to Chapter 23.)
2. Apply power to the KMA-24H audio/ICS panels. Select MKR in the PHONE switchbank.
3. On test equipment, select a 75 MHz output and position modulation control to 400 Hz. The outer (O) marker (blue) light should illuminate and flash at a rate of two flashes per second. The headset audio should be a 400 Hz tone at two dashes per second.
4. On test equipment, position modulation control to 1300 Hz. The middle (M) marker (amber) light should illuminate and flash in dots and dashes. Headset audio should be 1300 Hz tone at a rate corresponding to the flashing amber light.
5. On test equipment, position modulation control to 3000 Hz. The inner (A) marker (white) should illuminate and stay on. The headset audio should be a continuous 3000 Hz tone.
6. Position sensitivity select (HI-LO-TEST) switch from HI to LO. Compare duration of aural and visual signal in both positions of the select switch.
7. With the select switch in the LO position, the duration of the signals should be noticeably shorter.
8. Remove power from test equipment. Position HI-LO-TEST switch to TEST.
9. The marker beacon system KR-21 and KA-10 annunciator lights (A-O-M) should illuminate simultaneously.
10. Remove power from receiver by deselecting MKR on the KMA-24H audio/ICS panel.

11. Remove power from essential 1 and essential 2 buses.

12. Remove external power from helicopter.

34-72. TROUBLESHOOTING-MARKER BEACON SYSTEM.

NOTE

For troubleshooting, refer to Table 34-16 and the marker beacon system and audio/ICS wiring diagrams in Chapter 98.

NOTE

Reference to position(s) of operator(s) in troubleshooting chart is intended to mean “pilot” and/or “copilot”.

34-73. MARKER BEACON RECEIVER (KR-21).

The KR-21 marker beacon receiver (Figure 23-1) is a crystal controlled super-heterodyne receiver which generates signals for aural or visual presentation when the aircraft passes over marker beacons located on ILS approach courses. The KR-21 marker beacon receiver is mounted in the instrument panel at the pilot position.

34-74. REMOVAL-MARKER BEACON RECEIVER (KR-21).

1. Ensure that electrical power is off.
2. Remove screws attaching center panel to main instrument panel.
3. Working through center panel opening, remove electrical connector from receiver.

Table 34-16. MARKER BEACON SYSTEM

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
A-O-M lights in both positions inoperative after positioning HI-LO-TEST switch to TEST.	Dirty/loose/defective ground and/or power wiring connection(s).	Clean/tighten/repair ground and/or power wiring connection(s).
	Defective receiver.	Replace receiver.
A-O-M lights inoperative, both positions; audio present in headsets.	Dirty/loose/defective ground and/or interconnect wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).
	Defective receiver.	Replace receiver.
A-O-M lights inoperative, one position; audio present in headsets.	Dirty/loose/defective ground and/or interconnect wiring connection(s).	Clean/tighten/repair ground and/or connection(s).
	Defective lamps.	Replace lamps.
	Defective receiver or light adapter.	Replace receiver or light adapter.
No audio, both positions; A-O-M lights illuminate in both positions.	Dirty/loose/defective ground and/or shield wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).
	Defective KMA-24H audio/ ICS panel. Defective receiver.	Replace panel. Replace receiver.

Table 34-16. MARKER BEACON SYSTEM (Cont'd.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
A-O-M lights inoperative, no audio, both positions; lights illuminate in "TEST".	Defective antenna.	Replace antenna.
	Dirty/loose/defective antenna coaxial cabling/connection(s).	Clean/tighten/repair/replace cabling connection(s).
	Defective receiver.	Replace receiver.
	Dirty/loose/defective ground/interconnect wiring/ connection(s).	Clean/tighten/repair wiring/ connection(s).
Any one light or lights fail(s) on either indicator.	Defective white, blue, or amber lamp.	Replace lamp.

4. Remove four screws attaching receiver to panel.
5. Remove receiver.

34-75. INSTALLATION-MARKER BEACON RECEIVER (KR-21).

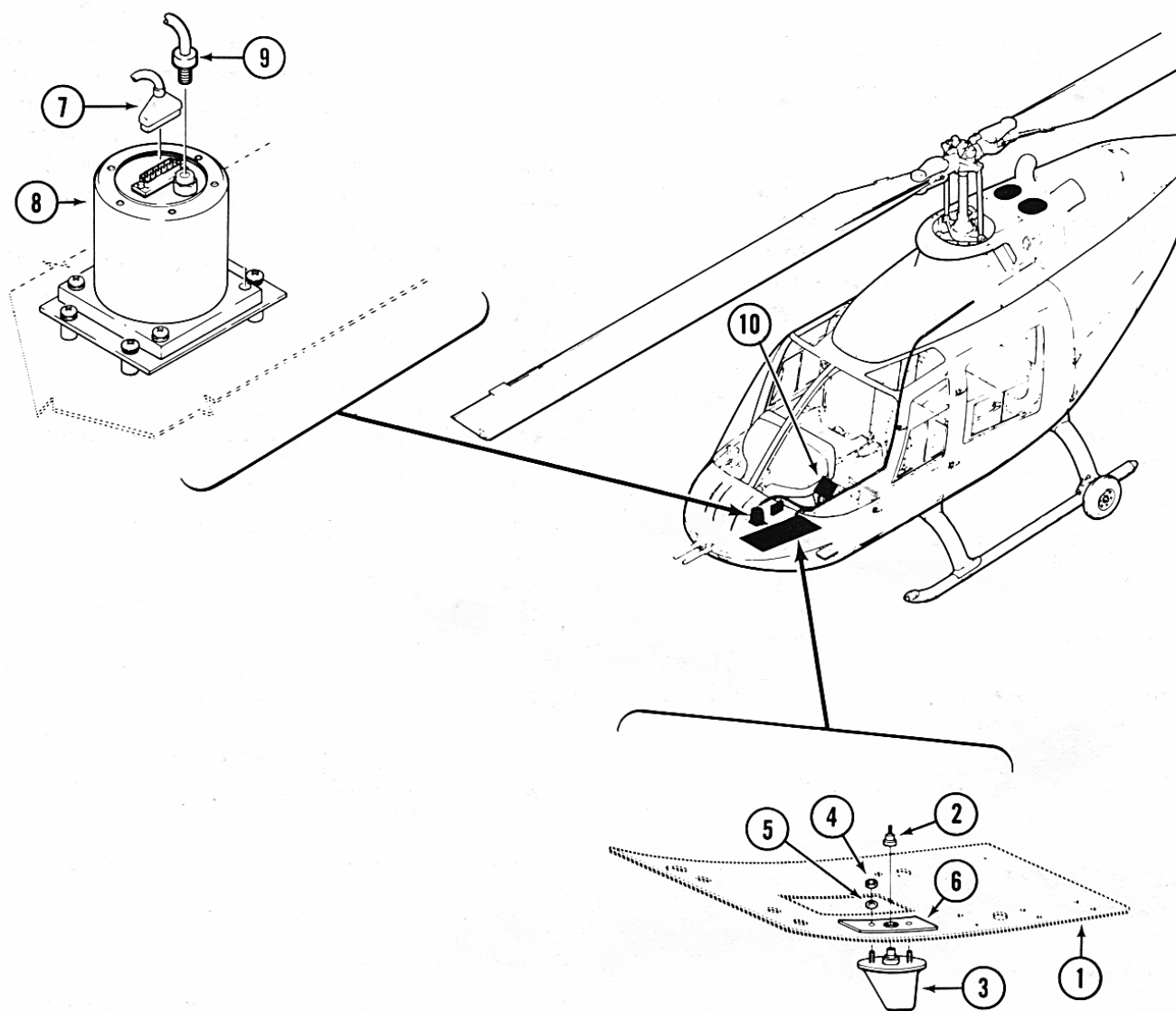
1. Ensure that electrical power is off.
2. Install receiver in center panel. Secure with screws.
3. Attach electrical connector to receiver.
4. Close and secure center panel to main instrument panel using screws.
5. Perform operational check of marker beacon system. (Refer to paragraph 34-67.)

34-76. TRANSPONDER (KT-79).

1. The transponder positively locates and identifies the user within the air traffic control system. Pulsed transponder replies to ground interrogation confirm range and azimuth of the user to the radar site.
2. The transponder reply consists of a train of pulses, selective in number and intervals. A transmission containing only the aircraft identity code constitutes a Mode A reply. The code consists of four digits. The individual identity code is inserted with the code selector, a concentric knob within the function selector.

A caret under the code readout identifies the digit being affected by the code selector; depressing the code selector moves the caret between the digits. The readout ON will be illuminated when transponder operates in Mode A. Use of the transponder with the blind encoder adds the capability of aircraft altitude reporting to each transmission, which constitutes a Mode C reply (identity plus altitude). The function selector has to be positioned to ALT. The readout ALT will be illuminated when the transponder operates in Mode C.

3. When the IDT (identification) button is depressed, it activates the special pulse identification (SPI) option, which will cause the user's return on the ground radar scope to bloom. (This option is normally initiated at the controller's request.)
4. A guarded EMR (emergency) button offers instantaneous recall of code 7700; the transponder will continuously transmit this code, and the code will appear in the legend, when the button is momentarily depressed.
5. A flashing R (reply) will appear in the legend when the transponder is replying to an external interrogation. If the R flashes almost continuously, the transponder is responding to more than one interrogation.



1. Access panel
2. Transponder antenna cable connector
3. Transponder antenna KA-60
4. Nut (2)
5. Washer (2)
6. Doubler

7. Electrical connector
8. Blind encoder A30
9. Static connector
10. Transponder KT-79

Figure 34-8. Transponder and Blind Encoder System Component Locations

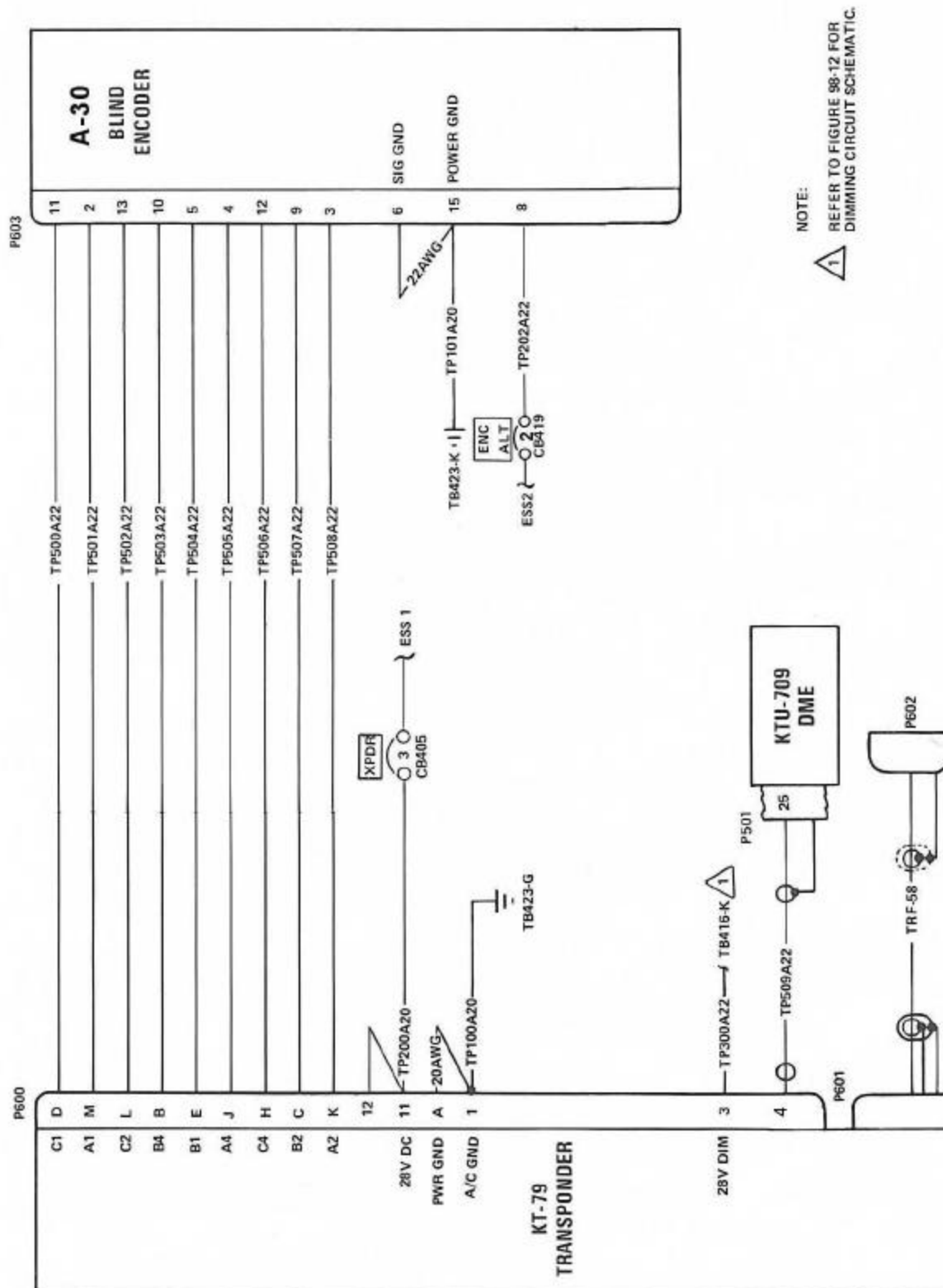


Figure 34-9. Transponder and Blind Encoder System Wiring Diagram

34-77. REMOVAL-TRANSPONDER (KT-79).

1. Ensure that electrical power is off.
2. Using 3/32" Allen wrench, turn transponder locking-screw counterclockwise until transponder is free from tray.
3. Remove transponder.

34-78. INSTALLATION - TRANSPONDER (KT-79).

1. Ensure that electrical power is off.
2. Looking at bottom of transponder (Figure 23-10), ensure front lobe of the holddown device is in a vertical position.
3. Slide transponder into mounting tray until front lobe of holddown device contacts tray.



DO NOT OVERTIGHTEN LOCKING SCREW.

4. Using 3/32" Allen wrench turn locking screw clockwise until rear lobe engages with tray slot. Continue turning wrench until screw is tight.
5. Perform operational check of transponder. (Refer to Appendix E.)

34-79. TRANSPONDER ANTENNA (KA-60).

The KA-60 antenna (Figure 23-9) is a blade antenna matched to the center frequency range of the transponder, which operates between 1030 MHz and 1090 MHz. The impedance matching of the system requires between 9 to 17.5 feet of RG 58 cable to the antenna which provides a 50 ohm load and VSWR of 1.2 to 1 or less. The antenna is mounted on a removable panel located on the underside of the nose of the helicopter.

34-80. REMOVAL-TRANSPONDER ANTENNA (KA-60).

1. Ensure that electrical power is off.
2. Remove screws and washers attaching lower from access panel (1, Figure 23-10).
3. Disconnect antenna cable connector (2) from antenna (3).

4. Remove nuts (4) and washers (5) attaching antenna (3) to panel and doubler (6).
5. Remove antenna and doubler.

34-81. INSTALLATION - TRANSPONDER ANTENNA (KA-60).

1. Ensure that electrical power is off.
2. Install antenna (3, Figure 23-10) and doubler (6) on access panel (4). Secure antenna using washers (5) and nuts (4).
3. Attach antenna cable connector (2) to antenna (3).
4. Install access panel and secure using screws and washers.
5. Perform operational check of transponder. (Refer to Appendix E.)

34-82. BLIND ENCODER (A-30).

The A-30 blind encoder (Figure 23-10) is connected to a static pressure (vacuum) source, which acts on the internal barometric diaphragm and converts altitude pressure into electrical analog signals. The encoder, subsequently, converts the analog to digital outputs for application to the transponder. The transponder transmits this encoded altitude information on demand in MODE C. The blind encoder is mounted underneath the center console. (See Chapter 31 for static system interconnect diagram.)

34-83. REMOVAL-BLIND ENCODER (A-30).

1. Ensure that electrical power is off.
2. Remove lower right pedestal access panel.
3. Disconnect electrical connector (7, Figure 23-10) from encoder (8).
4. Disconnect static (line) connector (9) from encoder by loosening B-nut.
5. Loosen holddown knob until encoder is free.
6. Remove encoder.

34-84. INSTALLATION-BLIND ENCODER (A-30).

1. Ensure that electrical power is off.
2. Install encoder (8, Figure 23-10) in mount and

secure with holddown knob.

3. Connect static (line) connector (9) to encoder (8) by aligning and tightening B-nut.
4. Connect electrical connector (7) to encoder (8).
5. Attach access panel to pedestal.
6. Perform operational check of transponder and blind encoder system. (Refer to Appendix E.)

34-85. LIGHT ADAPTER (KA-40).

The KA-40 light adapter (Figure 31-10 (46)) is a slave indicator to the KR-21 marker beacon receiver. A blue (O), amber (M), and white (A), light illuminates in consonance with light display on receiver.

34-86. REMOVAL-LIGHT ADAPTER (KA-40).

1. Ensure that electrical power is off.
2. Remove screws attaching center panel to main instrument panel.
3. Working through center panel opening, remove electrical connector from adapter.
4. Remove screws attaching adapter to panel.
5. Remove adapter.

34-87. INSTALLATION-LIGHT ADAPTER (KA-40).

1. Ensure that electrical power is off.
2. Install adapter in center panel. Secure with screws.
3. Attach electrical connector to adapter.
4. Close and secure center panel to main instrument panel using screws.
5. Perform operational check of marker beacon system. (Refer to paragraph 34-67.)

34-88. MARKER BEACON ANTENNA (KA-23).

The KA-23 marker beacon antenna (Figure 34-6) is a blunt blade antenna used in the marker beacon system. It is mounted on the front center underside of the helicopter. The antenna is constructed for a 75 MHz frequency response. The input impedance of the antenna is 50 ohms.

34-89. REMOVAL-MARKER BEACON ANTENNA (KA-23).

1. Ensure that electrical power is off.
2. Remove screws attaching antenna access panel (4, Figure 34-6) to structure.
3. Disconnect antenna cable connector (5) from antenna (6).
4. Remove screws (7) and washers (8,9) from antenna (6).
5. Remove antenna.

34-90. INSTALLATION-MARKER BEACON ANTENNA (KA-23).

1. Ensure that electrical power is off.
2. Align antenna (6, Figure 34-6) and three washers (9) with mounting holes in antenna access panel (4).
3. Install antenna on access panel and secure with washers (8,9) and screws (7).
4. Connect antenna cable connector (5) to antenna (6).
5. Close access panel (4). Secure with washers and screws.
6. Perform operational check of marker beacon system. (Refer to paragraph 34-67.)

34-91. DME/TACAN SYSTEM.

1. The DME (distance measuring equipment) / TACAN (tactical airborne navigation) system consists of the KTU-709 transceiver (interrogator-receiver), KDI-572 DME master indicator, KDI-573 slave indicator and KA-60 antenna.
2. The system furnishes airborne slant-range and bearing information to a selected TACAN or VORTAC (VOR co-located with TACAN) station. Operating range is limited by line-of-site. The system can be selected to operate on any 252 channels. The channels operate in the 1025 to 1150 MHz frequency range for interrogation (transmit) and the 962 to 1213 MHz frequency range during reception.
3. TACAN activation, channel selection, and frequency tuning are effected with the KNS-81 receiver. TACAN station frequencies can be entered into nonvolatile memory (NVM) for ready channelization.

4. The DME master indicator is located on the right (pilot) side, and the DME slave indicator is located on the left (copilot) side of the instrument panel. The indicators portray distance, time-to-station and ground speed. Bearing from VORTAC or VOR waypoints may be called up for display and substituted for ground speed readout by manipulation of NAV 1 (KNS-81) system controls (RAD button).
5. Bearing to TACAN station, selected received TACAN channel, and TACAN station transmitting frequency are displayed on NAV 1 receiver panel. TACAN bearing (to station) is presented on the HSI, if NAV 1 is selected.
6. When the transceiver establishes lock-on to a DME/TACAN station it generates a 1350 Hz tone. This audio is routed to the KMA-24H audio/ICS panel for presentation in the aircrew headset (s).
7. The TACAN TEST switch located in the instrument panel serves as valuable trouble-shooting aid of the DME/TACAN and VOR system. It allows functional checkout/verification of RF connections and interconnects from the KTU-709 transceiver to the indicators. The test signals are generated in the transceiver.

34-92. OPERATIONAL CHECK-DME/TACAN SYSTEM.



BEFORE CONNECTING EXTERNAL ELECTRICAL POWER, VERIFY THE FOLLOWING:

- 1. ESS 1 BUS SUPPLY BAT CIRCUIT BREAKER IS OPEN.**
 - 2. BUS TIE RELAY CIRCUIT BREAKER IS OPEN.**
 - 3. BOTH AVIONICS MASTER/OFF SWITCHES ARE OFF.**
1. Perform the following preliminary steps:
 - a. Connect external power source.
 - b. Apply power to the essential 1 and essential 2 buses. (Refer to Chapter 23.)

NOTE

An AN/ARM-25B, AN/URM-101, or equivalent test set is required for the following procedures.

2. Position test set approximately 50 feet away and in line-of-sight with the DME/TACAN antenna.
3. Apply power to KMA-24H audio/ICS panel(s), KNS-81 (NAV 1) receiver, and DME indicator(s). (Refer to power-on and parameter selection procedures in respective equipment description/operational check.)
4. Call up TAC(an) function on the activated receiver panel (NAV 1).
5. Apply power to test set.
6. Insert TACAN channel compatible with test set frequency range. Select channel at low end of TACAN frequency spectrum (station transmitter). Tune receiver to selected channel frequency, if necessary.
7. Position test set selector to minimum range (simulated range below 10 NM).
8. TACAN receiver should lock on to test set signal.
 - a. DME master indicator should show distance (± 0.1 NM) to station (simulated).
 - b. NAV receiver panel should present readout of actual bearing (± 1.5 degrees) to station (simulated-relative to test set position).
9. Position test set selector to maximum range.
10. TACAN transceiver should remain locked on to the test signal (simulated range of at least 150 NM). DME master indicator and NAV receiver panel should reflect received signal information, as in step 8.a. and b., above (range tolerance $\pm 0.14\%$).
11. Repeat steps 6 through 10, above, for a test set and transceiver/receiver setting at the high end of the TACAN frequency spectrum.
12. If additional verification of angular tracking is desired, reposition test set at a different relative bearing location to the helicopter, and repeat steps 6 through 10, above.

13. If NAV 1 is the receiver selected for the operational check, the HSI will also present TACAN station bearing (simulated).
14. Remove power from essential 1 and essential 2 buses.
15. Remove external power from helicopter.

34-93. TROUBLESHOOTING-DME/TACAN SYSTEM.

NOTE

For troubleshooting refer to Table 34-17 and navigation and navigational aids systems and audio/ICS wiring diagrams in Chapter 98.

NOTE

Reference to position(s) in troubleshooting chart is intended to mean "pilot" and "copilot".

34-94. DME/TACAN TRANSCEIVER (KTU-709).

1. The KTU-709 transceiver (Figure 34-10) is a total solid-state, bearing and distance sensitive receiver. It is located in the aft avionics bay, above the baggage compartment. The transceiver is powered by 28vdc from the essential bus 2.
2. A TACAN system TEST switch is located immediately to left of the KDI-572 DME master indicator. When the TACAN TEST switch is activated (closed), it provides a ground to and initiates a test-routine in the transceiver. The generated test-signals contain fixed bearing and distance information, and are used to test interface integrity and circuit operation of and between all DME/TACAN/VOR components. Fault free completion of testing causes 0.1 NM 00KT 12 MIN readouts to appear on the DME indicators.

Table 34-17. DME/TACAN SYSTEM

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Power cannot be applied to TACAN/DME receiver	Defective DME master indicator. Defective transceiver. Defective receiver or light adapter. Dirty/loose/defective ground and/or power wiring and/or connection(s) or circuit breaker(s).	Replace indicator. Replace transceiver. Replace receiver or light adapter. Clean/tighten/repair wiring and/or connection(s) or replace circuit breaker(s).
No DME/TACAN audio present in headsets, both positions.	Defective receiver. Defective receiver. Dirty/loose/defective wiring and/or connection(s).	Replace receiver. Replace receiver. Clean/tighten/repair wiring and/or connection(s).
No DME/TACAN audio present in headset, one position.	Defective headset. Defective KMA-24H audio/ICS panel. Dirty/loose/coaxial cabling, wiring and/or connection(s).	Replace headset. Replace panel. Clean/tighten/repair/replace cabling, wiring and/or connection(s).

Table 34-17. DME/TACAN SYSTEM (Cont.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
No DME/TACAN readouts, both indicators and NAV receivers; audio present.	Defective DME master indicator.	Replace indicator.
	Dirty/loose/defective wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).
No DME indicator readout, left position.	Defective DME slave indicator.	Replace indicator.
	Defective DME master indicator.	Replace indicator.
	Dirty/loose/defective wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).
No DME/TACAN readouts, both NAV receivers.	Defective transceiver.	Replace transceiver.
	Dirty/loose/defective wiring and/or connection(s) or circuit breaker(s).	Clean/tighten/repair/replace wiring and/or connection(s), or circuit breaker(s).
No DME/TACAN readouts, one NAV receiver.	Defective NAV transceiver.	Replace NAV transceiver.
	Dirty/loose/defective wiring and/or connection(s) or circuit breaker(s).	Clean/tighten/repair/replace wiring and/or connection(s), or circuit breaker(s).
No DME/TACAN readouts, both DME indicators, both NAV receivers, and no audio present.	Defective transceiver.	Replace transceiver.
	Defective antenna.	Replace antenna.
	Dirty/loose/defective coaxial cabling/connection(s).	Clean/tighten/repair/replace cabling/connection(s).
DME/TACAN system intermittently breaks lock.	Defective transceiver.	Replace transceiver.
	Defective antenna.	Replace antenna.
	Dirty/loose/defective coaxial cabling/connection(s).	Clean/tighten/repair/replace cabling/connection(s).
Waypoint bearing cannot be inserted into DME indicator(s).	Defective DME master indicator.	Replace indicator.
	Defective NAV receiver.	Replace receiver.
	Dirty/loose/defective wiring and/or connection(s).	Clean/tighten/repair wiring and/or connection(s).

34-95. REMOVAL - DME/TACAN TRANSCEIVER (KTU-709).

1. Ensure that electrical power is off.
2. Gain access to transceiver (1, Figure 34-8) through opening in baggage compartment roof.
3. Disconnect antenna cable connector (2) and electrical connector (3) from transceiver.
4. Loosen holddown knob (4) until clear of transceiver.
5. Slide transceiver forward until free of mounting rack.

34-96. INSTALLATION-DME/TACAN TRANSCEIVER (KTU-709).

1. Ensure that electrical power is off.
2. Working through opening in baggage compartment roof, slide transceiver (1, Figure 34-8) into mounting rack (5). Ensure rear of transceiver fits under flange of rack.
3. Engage and tighten holddown knob (4) until transceiver is secure.
4. Connect antenna cable converter (2) and electrical connector (3) to transceiver.
5. Perform operational check of DME/ TACAN system. (Refer to paragraph 34-79.)

34-97. DME/TACAN ANTENNA (KA-60).

The KA-60 TACAN antenna (Figure 34-8) is a blade type of antenna which is part of the TACAN system. Its acceptable frequency range covers 962 through 1,213 MHz. The antenna is mounted on the right underside of the helicopter below the pilot seat.

34-98. REMOVAL – DME / TACAN ANTENNA (KA-60).

1. Ensure that electrical power is off.
2. Remove pilot seat and seat pan.
3. Disconnect antenna cable connector (6, Figure 34-10) from antenna (7).
4. Remove nuts (8) and washers (9) attaching antenna (7) to bottom skin.
5. Remove antenna.

34-99. INSTALLATION-DME/TACAN ANTENNA (KA-60).

1. Ensure that electrical power is off.
2. Align antenna (Figure 34-10) with mounting holes on underside of helicopter.
3. Install antenna and secure with washers (9) and nuts (8).
4. Connect antenna cable connector (6) to antenna.
5. Install pilot seat panel and seat pan.
6. Perform operational check of DME/ TACAN system. (Refer to paragraph 34-79.)

34-100. DME INDICATORS (KDI-572, KDI-573).

1. The KDI-572-573 indicators (Figure 34-8) display range to the nearest 0.1 nautical mile (NM) from 0 to 99.9 NM to the nearest 1 NM from 100 to 389 NM. Ground speed readout has a resolution of 1 NM/HR (knot) from 0 to 999 knots. Time-to-station or time-from-station indicates to the nearest minute from 0 to 99 minutes. The display will show 99 minutes for any inserted time-to-station in excess of 99 minutes.
2. When the KNS-81 (NAV 1) receiver are used in any combination with the KTU-709 transceiver as data source, the DME indicators reflect this with an RNAV readout.
3. Dashes in the indicator readout windows portray that source equipment (transceiver and/or receiver) is in any station search mode, and that lock-on has not been incidental or has been lost. The display is called up immediately after power application or if power has been momentarily interrupted while in the HLD mode.
4. The KDI-573 slave indicator display is identical to the KDI-572 master indicator presentation.
5. Automatic dimming circuits in both indicators adjust the brightness of the displays to compensate for changes in the ambient light level.

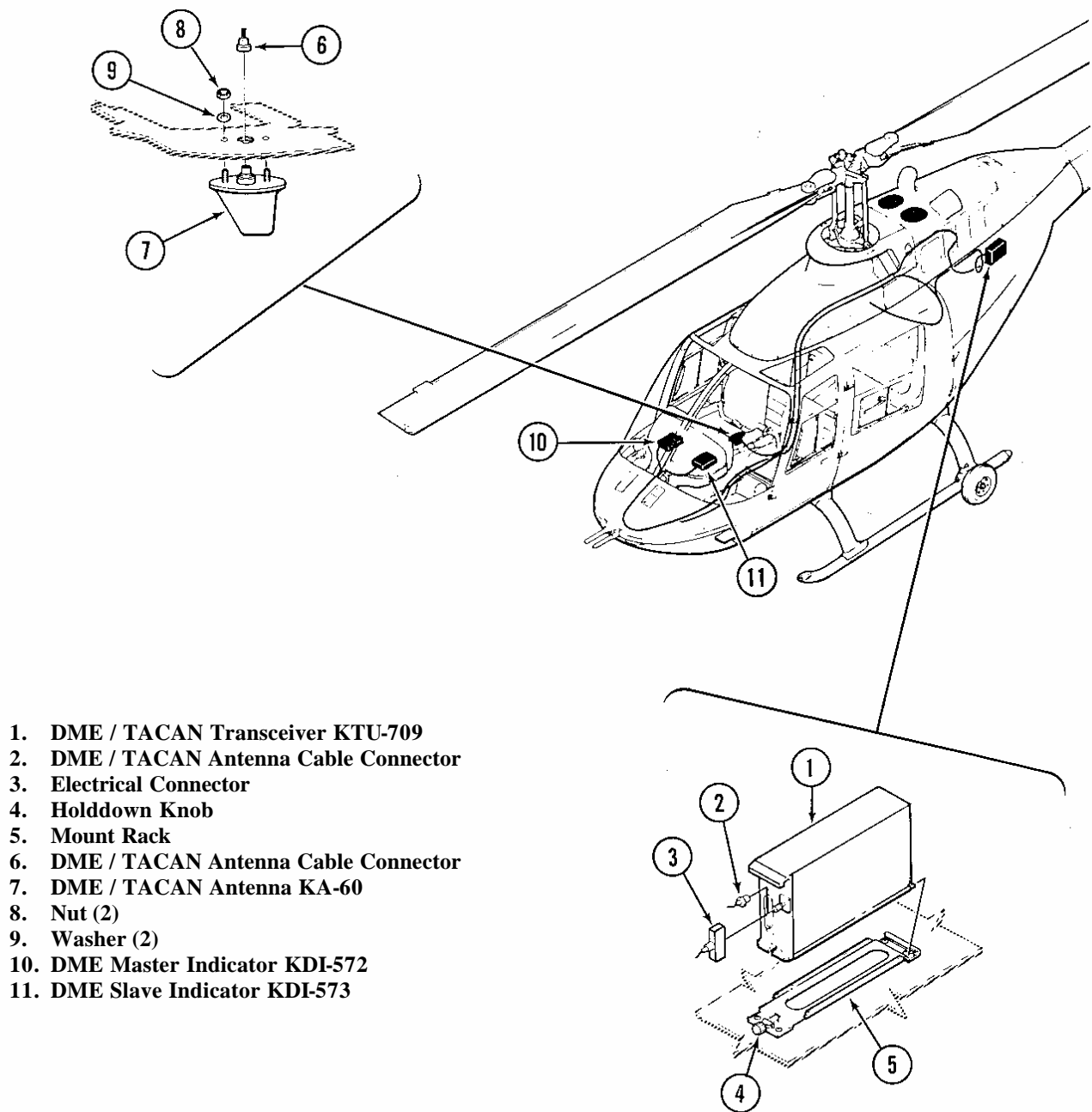


Figure 34-10. DME/TACAN System Component Locations